Cumulative Effects Assessment, Strategic Planning and Urban Regeneration: The Case of the Thames Gateway

by

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Declaration of Own Work

I declare that this thesis:

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is entirely my work and that where any material could be construed as the work of others, it is fully cited and referenced, and/or with appropriate acknowledgement given.

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Abstract

Cumulative effects assessment (CEA) is the process of systematically analysing and assessing the consequences, sources and pathways of cumulative impacts of multiple activities. CEA is required by EC Directives: 85/337/EEC, 97/11/EC, and 92/43/EC. Despite these requirements, cumulative effects have not been adequately addressed in environmental impact assessments (EIAs). The Strategic Environmental Assessment (SEA) Directive 2001/42/EC (to be implemented in the U.K. in 2004) requires that cumulative effects should be addressed in strategic planning.

The consideration of cumulative impacts was investigated by analysing 50 EISs and 15 environmental and sustainability appraisals of local development plans to establish current practice. The results of the reviews suggested that cumulative effects were insufficiently considered. A semi-structured interview survey with experts and practitioners was undertaken to seek opinions on how CEA could be integrated into strategic planning.

The research focused on urban regeneration to explore cumulative effects because it illustrates cumulative effects well, particularly those related to space and time crowding. Thames Gateway was chosen as a case study because it is an area targeted for urban regeneration for the next 20 years.

A CEA draft framework was developed, based on the literature review, the EIS and appraisals review and consultations. The framework integrates CEA into the SEA and plan-making processes and consists of a systematic procedure, methods and guidelines. The draft framework was evaluated through consultations with experts and practitioners and application to four actual planning sub-case studies in the Thames Gateway to examine its usefulness in practice. The network analysis method was applied to the sub-case studies to identify and define cumulative impacts in urban regeneration. As a result of the evaluation, a revised framework was produced. The final CEA Framework should help ensure that cumulative effects are considered more effectively in strategic planning and fulfil the requirements of the SEA Directive.

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Publications

The following publications contain material originating from the research carried out for this thesis:

Cooper, LM and WR Sheate (2002) Cumulative effects assessment: A review of UK environmental impact statements. *Environmental Impact Assessment Review*, 22 (4), 415- 439.

Cooper, LM and WR Sheate (2004) Integrating cumulative effects assessment into UK strategic planning: implications of the European SEA Directive. *Impact Assessment and Project Appraisal*, 22 (1), 5-16.

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Abbreviations

CEA	Cumulative Effects Assessment
CEAp	Cumulative Effects Appraisal
CEAA	Canadian Environmental Assessment Agency
CEARC	Canadian Environmental Assessment Research Council
CEC	Commission of the European Communities
CIS	Cumulative Impact Study
CEQ	Council of Environmental Quality
CCW	Countryside Council for Wales
DEFRA	Department for Environment, Food and Rural Affairs
DETR	Department of Environment, Transport and the Regions
DoE	Department of the Environment
DoH	Department of Health
DoT	Department of Transport
DTI	Department of Trade and Industry
DTLR	Department of Transport, Local Government and the Regions
EA	Environmental Assessment
EAp	Environmental Appraisal
EC	European Community
EELGC	East of England Local Government Conference
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EU	European Union
GIS	Geographic Information System
GLA	Greater London Authority
GOSE	Government Office for the South East
GO-East	Government Office for the East of England
GOL	Government Office for London
IAIA	International Association for Impact Assessment
KCC	Kent County Council
LCA	Life Cycle Assessment
LDA	London Development Agency
LPA	Local Planning Authority
MC	Medway Council
PPG	Planning Policy Guidance Note
PPP	Policy, Plan, Programme
NGO	Non-Government Organisation
RDA	Regional Development Agency
RPG	Regional Planning Guidance
SEEDA	South East England Development Agency
SEERA	South East England Regional Assembly
SA	Sustainability Appraisal
SEA	Strategic Environmental Assessment
SoS	Secretary of State
TGLP	Thames Gateway London Partnership
TGSE	Thames Gateway South Essex Partnership
TGK	Thames Gateway Kent
UDC	Urban Development Corporation
VEC	Valued Ecosystem Components

SECTION I - RESEARCH PROBLEM AND APPROACH

Chapter 1: The Research Project

1.1 Introduction

Cumulative effects are changes to the environment that are caused by impacts from many actions. Cumulative effects or impacts range from simple additions of impacts to complex interactions of environmental stresses. Early work on environmental assessment has focused on assessing cumulative effects in project-specific assessments. However, the weaknesses of this approach indicated a need for addressing these effects earlier in the planning process and a broader context for considering a wide range of actions. Cumulative effects assessment (CEA) during strategic planning could therefore examine effects that may occur as a result of many activities within the area. Strategic Environmental Assessment (SEA) has been formulated as a process to guide development and provides an appropriate context for CEA. The EU Directive 2001/42/EC *on the assessment of certain plans and programmes on the environment* (the SEA Directive) requires the assessment of cumulative effects, placing CEA firmly on the planning agenda.

This introductory chapter sets out the background to the research project and describes the importance of CEA. Then relevant legislation on CEA and the potential role of CEA in strategic planning and assessment are briefly discussed. An overview of the research project in section 1.3 states the research problem and questions and presents the methodology adopted for the research. Finally, the structure of the thesis is outlined in section 1.4.

1.2 Background

1.2.1 Cumulative effects

Cumulative effects have been defined in a variety of ways. A broad but useful definition refers to cumulative effects as "*the net result of environmental impact from a number of projects and activities...combined within a time and space framework established through direct and indirect activity relationships* " Sadler (1996, p.161). Cumulative effects can accumulate in incremental or synergistic ways and typologies have been developed to classify them (e.g. Sonntag *et al*, 1987; Spaling 1984). The concept was originally introduced in environmental impact assessment (EIA) procedures required under the US National Environmental Policy Act of 1969 (NEPA).

Since then, the concept has been gradually developed and incorporated into practice. Early work on cumulative effects, however, focused on project related effects although there are some cases where cumulative effects approaches have been used as an integral part of regional or land use planning.

1.2.2 Importance of CEA

It is recognised that EIA has an important role to play in improving management and planning to achieve sustainable development (Lawrence, 1997). However, as experience with EIA has grown, some problems have become evident: significant impacts can occur from the accumulation of relatively minor impacts; project level EIAs cannot fully address cumulative impacts because of limited space and time frameworks and major environmental impacts can result from policies, plans and programmes which are not addressed under project level assessments. The need to address these effects came in the form of a tool called cumulative effects assessment (CEA). Cumulative effects assessment (also referred to as cumulative impact assessment) is *"the process of systematically analysing and evaluating cumulative environmental change"* (Spaling and Smit, 1993).

1.2.3 CEA, Planning and SEA

Cumulative effects can occur in varying scales, from the cumulative impact of noise affecting a neighbourhood to acid rain affecting several countries. Cumulative impacts manifested at regional, national or international scale can only be controlled by planning or managing development at that level (Sonntag *et al*, 1997). There are ways to address such effects at strategic level: as a CEA for a particular area or region as part of planning or as part of the assessment of the plan. Strategic environmental assessment (SEA) refers to the application of EIA at the level of strategic planning and policy making (Ortolano and Shepherd, 1995). SEA evolved as an improvement over project EIA, which is generally reactive, occurs too late in the process to examine other real alternatives and it does not usually adequately consider cumulative impacts. Thus, much of the pressure to legislate for SEA has emerged out of concern over progressive damage to natural systems due to cumulative effects (Treweek, 1999).

1.2.4 CEA and the SEA Directive

In 2001, the EU legislated for SEA with the adoption of Directive 2001/42/EC *on the assessment of the effects of certain plans and programmes on the environment.* This

Directive was adopted on the 27th June 2001, with member states having until 21st July 2004 to incorporate it into national law. The SEA Directive provides an opportunity for the assessment of cumulative effects at strategic level by requiring the consideration of: "*the likely significant effects ....including cumulative and synergistic effects on the environment....*" (Annex I) and the criteria for determining the likely significance of effects include "*the cumulative nature of the effects*" (Annex II).

1.3 Research Overview

The overall aim of the research project was to explore how cumulative effects assessment could be integrated into strategic planning in the UK. Legislation and policies on environmental protection have required the consideration of these effects in planning. The consideration of cumulative effects in EIA has been required in the UK since the EC Directive (85/337/EEC) was implemented in 1988. The Amendment Directive 97/11/EC and implementing UK Regulations strengthened these requirements. Another piece of legislation that requires the consideration of cumulative effects at both project and strategic levels is the EC Habitats Directive 92/43/EEC. Government guidance on sustainability appraisal require that it should "evaluate the cumulative effects in relation to options..." (PPG11: Regional Planning, 2000). However, consideration of cumulative effects at project and strategic levels has been poor (see chapter 6). The research problem can be stated as:

Cumulative effects are not considered adequately in the UK planning and environmental assessment processes.

A detailed analysis of the research problem was undertaken to gain a better insight into the problem and its underlying causes. A review of a sample of environmental impact statements (EISs) and environmental/sustainability appraisals provided an understanding of the issues in addressing such effects both at project and strategic levels. Furthermore, the literature review indicated that project EIAs cannot adequately address cumulative effects and these problems could be better addressed at strategic levels. CEA therefore has the potential to further environmental protection by extending its use from project to strategic levels. From this, the main research question was derived:

How could cumulative effects assessment be applied more effectively in the planning process?

To address this research question, a series of detailed research questions were formulated and a research methodology designed to respond to them. The research therefore sought to:

- Describe how CEA has developed in terms of research, guidance and practice;
- Develop a Draft CEA Framework for plans based on literature reviews, the results of EIS and environmental/sustainability appraisal reviews and consultations with participants in planning;
- Evaluate the Draft Framework through consultations with experts and practitioners;
- Apply the Draft Framework to case studies to investigate its usefulness in practice;
- Revise the Draft Framework to produce the Final Framework based on its evaluation and application.

The following aspects for developing a CEA framework were investigated: the background issues; a CEA procedure that could fit into the plan-making and assessment process, taking into account the requirements of the SEA Directive and appropriate methods which could be of practical use to planners and practitioners. The final framework consisted of a systematic procedure and methods for undertaking cumulative effects assessment within SEA and plan-making processes. So that the framework could be useful to planners and practitioners, it was produced in the form of guidelines. The research methodology used a number of qualitative research methods including documentary review, semi-structured interview surveys and case study analysis.

1.4 Thesis Structure

The thesis consists of four sections:

- Section I (Chapters 1 and 2) sets out the research problem, research questions and research strategy employed.

- Section II (Chapters 3-8) presents the findings from the literature review and provides the context for the research. Chapter 3 introduces CEA concepts and theory while Chapter 4 discusses the practice of CEA. Chapter 5 sets the context for CEA and discusses the UK planning system and appraisals of plans. Chapter 6

presents findings from the review of EISs and environmental/sustainability appraisals to validate the research problem and inform the development of the framework.

- Section III (Chapters 7-12) presents the development and refinement of a framework for applying CEA at strategic level and is made up of five elements:
  - Chapter 7 introduces Strategic Environmental Assessment and the role of CEA in SEA and the requirements of the SEA Directive.
  - Chapter 8 focuses on cumulative effects of a sector: urban regeneration and introduces the case study area, Thames Gateway.
  - Chapter 9 details the findings of the semi-structured interview survey on how a CEA framework could be incorporated into strategic planning. It also discusses the constituents of the framework: procedure and methods, in particular, the network analysis method.
  - Chapter 10 discusses the application of the framework to case studies.
  - Chapter 11 presents the results of the evaluation of the framework by experts and outlines the revisions to the framework in the light of the application and evaluation.

- Section III (Chapter 12 presents the final Framework).

- Section IV (Chapters 13 and 14) draws together the various strands of the research. Chapter 13 discusses the findings of the research project and some key issues that emerged during the preparation of the strategic CEA framework. Chapter 14 presents the research conclusions and recommendations.

Chapter 2 - Research Methodology

2.1 Introduction

The aim of this research is to explore how CEA could be integrated into strategic planning and decision-making processes. This chapter describes the research methodology used in order to realise that aim. Initially, this chapter discusses the rationale for adopting an inductive, qualitative approach. The research questions that have emerged from research literature on CEA are then outlined. The methodology developed to address the research questions are set out below in sections 2.2 to 2.8. Each stage of the methodology is described, including the methods employed, the rationale for selecting them and the issues relating to them.

2.2 Research approach and strategy

The practice of research involves combining philosophical ideas with broad approaches to research strategy and implemented with specific procedures or methods (Cresswell, 2003). The main approaches to research include deductive and inductive approaches. The differences between these approaches to research are set out in Table 2.1.

Table 2.1 Differences between deductive and inductive approaches (adapted from Saunders et al, 2000)

Deductive approach	Inductive approach
Move from theory to data	Gaining an understanding of the meanings humans attach to events
Need to explain causal relationships between variables	A close understanding of research context
Collection of quantitative data	Collection of qualitative data
Highly structured approach & application of controls to ensure validity of data	A more flexible structure to permit changes of research emphasis as the research progresses
Researcher independent of what is being researched	Researcher is part of the research process
Necessity to collect samples of sufficient size to be able to generalise conclusions	Less concern with the need to generalise

In choosing a research approach the most important criterion is the nature of the research topic (Saunders et al, 2000). A topic where there is a wealth of literature from which a theoretical framework and hypotheses can be defined lends itself to the deductive approach. With research that is new and exciting much debate, and the concept or phenomena needs to be understood because there is little existing literature, it may be more appropriate to generate data and analyse what theoretical themes the data are suggesting (Saunders *et al*, 2000; Cresswell, 2003). Based on the

characteristics of the above approaches and for the following reasons: i) the topic of this research, *cumulative effects assessment* is in its infancy in the UK; ii) it is generating a lot of interest because it is required under the EU SEA Directive; iii) there is poor understanding of the concept; and iv) very little literature on the subject in the UK, it was decided to adopt an inductive approach.

The second element of the research approach is the strategy of inquiry. In empirical research there are alternative strategies of inquiry: quantitative and qualitative. These research approaches differ in terms of philosophical assumptions about the nature of reality, epistemology, values, rhetoric of research and methodology (Cresswell, 2003). Some differences between qualitative and quantitative paradigms are shown in Table 2.2.

Table 2.2 Differences between qualitative and quantitative research (adapted from Blaxter et al, 2001)

Quantitative Paradigms	Qualitative Paradigms
Seek the facts/causes of social phenomena	Concerned with understanding behaviour from the actors' own frames of reference
Obtrusive and controlled measurement	Naturalistic and uncontrolled observation
Objective	Subjective
Removed from the data: the 'outsider' perspective	Close to the data: the insider perspective
Ungrounded, verification oriented, reductionist, hypothetico-deductive	Grounded, discovery–oriented, exploratory, expansionist, descriptive, inductive
Outcome oriented	Process oriented
Reliable: hard and replicable data	Valid: real, rich, deep data
Generalizable: multiple cases	Ungeneralizable: limited cases
Particularistic	Holistic
Assume a dynamic reality	Assume a stable reality

Based on the above table, the inductive approach chosen for this research suggests a qualitative paradigm. Some strategies associated with qualitative research are: ethnographies, grounded theory, case studies, phenomenal research and narrative research Cresswell (2003). In the case study strategy the researcher explores in depth an activity or process and is the appropriate method to use when the phenomenon under study is not readily distinguishable from its context (Yin, 1994). The research strategy adopted for this thesis relies primarily on qualitative data collection and analysis techniques. It uses documentary analysis, interview surveys and case studies to answer

the research questions. The context and the case studies are discussed in detail in Section 2.8. Yin (1994) identifies five components of research:

- The research questions: how and why questions
- The propositions: proposal to answer the research question
- Units of analysis: selecting the context
- Logic linking the data to the propositions: developing data analysis strategies
- Criteria for interpreting the findings: techniques for analysing data

2.2.1 The research questions

The examination of CEA legislation, research literature and current practice led to the identification of the research problem:

Cumulative effects are not considered adequately in the UK planning and environmental assessment processes.

From this research problem the general research question was formulated and stated as:

How could CEA be applied more effectively in the planning process?

Yin (1994) suggested that the researcher begins with a general focus question that flows from the research idea, which then leads to more detailed questions. From the general research question, more detailed questions were formulated:

i) *To what extent and how were cumulative effects considered in environmental assessments of projects and plans?*

ii) *What changes in the environmental assessment and planning process are necessary to ensure that CEA is applied effectively?*

iii) *How could CEA be integrated into the strategic planning process?*

iv) *Could a framework that integrated CEA into the strategic environmental assessment of plans be developed which could assist planners and practitioners in considering cumulative effects more effectively?*

2.2.2 The Proposition

From the research questions, the following research proposition was formulated:

A framework that systematically integrates CEA into the strategic environmental assessment and plan-making process and provides guidelines to planners and practitioners could assist in more effective consideration of cumulative effects in the planning process.

The proposition suggested issues that should be investigated in order to answer the research question.

2.2.3 The unit of analysis

The unit of analysis for the case studies was the planning process for addressing cumulative effects. The unit of analysis is set within the context of the large case study, the Thames Gateway. At the *macro-level*, the Thames Gateway provided a regional perspective of cumulative effects issues. A single case study with embedded units of analysis was selected as the appropriate case study design. In order to increase the depth of the analysis, embedded units of analysis were incorporated into the case study. The Thames Gateway case study and embedded units of analysis focussed on three tiers of development planning:

1. regional[1] (Thames Gateway)
2. sub-regional (Thames Estuary, Ebbsfleet Valley & Creekside) } embedded units
3. local (Millennium Quarter) } embedded units

The Thames Gateway represented a revelatory case "*which was likely to lead to understanding and assertions*" (Stake, 1995). One of the aims of the case study was to facilitate understanding of cumulative effects. The Thames Gateway is an urban regeneration area of national importance where major developments have been implemented and many more proposed so that there are were many cumulative effects issues to be explored. Furthermore, urban regeneration schemes in the Thames Gateway have similarities with those in other urban areas in the UK: redevelopment of brownfield sites of mixed use developments in urban environments with potential for cumulative effects problems such as transport congestion and declining air quality. Like most regeneration areas, Thames Gateway covers several planning authority areas

[1] The Thames Gateway is treated as a region in this research project although it lies within three regions: Southeast England, London and East of England.

and so that any approach for addressing cumulative effects identified would have possible application in other areas.

Within this large case study are embedded units or *micro-level* sub-case studies: planning processes for addressing cumulative effects of urban regeneration schemes. The sub-case studies were used in applying the Draft CEA framework by examining its potential use in practice and testing the network analysis method. Three of the sub-case studies are urban regeneration plans. However, the fourth case study is a management plan which addresses, among other factors, the impacts of urban regeneration at a sub-regional level (see Chapter 10).

2.2.4 Linking data to the proposition

The research procedure as illustrated in Figure 2.1 shows how the data from each stage is sequentially linked to the proposition and development of the CEA framework in the following stages:

1. The literature review and preliminary investigations defined the research problem and refined the research questions, leading to the proposition.
2. Review of EISs and plan appraisals/ assessments established current practice which led to a better understanding of the problem and informed requirements for an effective CEA framework.
3. Findings from consultations with planners, practitioners and experts through semi-structured interviews informed the context for the Draft CEA framework and what useful features it should have.
4. A Draft CEA framework and guidelines were developed based on research literature on best practice, findings from the EIS and plan appraisal reviews and consultations.
5. The Draft Framework was evaluated using questionnaires which were sent to experts, planners and practitioners and applied to sub-case studies to examine its potential usefulness in practice.
6. The results of the questionnaires and case studies enabled the revision of the Draft Framework to produce a Final CEA Framework.

2.2.5 Criteria for interpreting the research findings

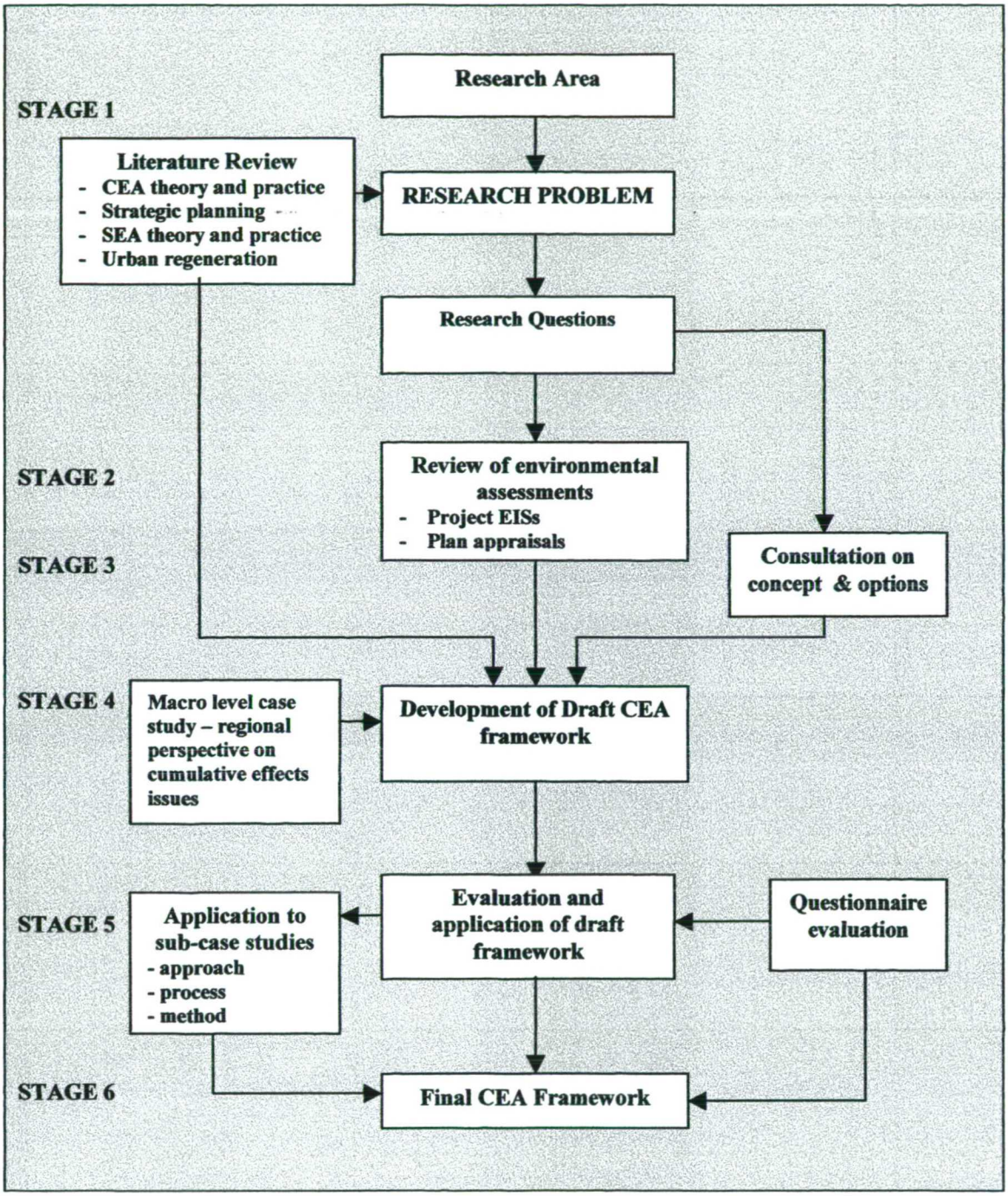
The criteria for interpreting data findings depended upon the method of data collection. Quantitative and qualitative analyses were undertaken depending on the type of data collected. For the EIS review and semi-structured interviews, both qualitative and quantitative analyses were employed. In the EIS review, quantitative analysis was used to measure the extent cumulative effects were considered in the sample while qualitative analysis indicated issues, such as the different concepts of cumulative effects (see Chapter 6). Data from the semi-structured interviews were used to identify emerging themes regarding cumulative effects issues, options for application of CEA at strategic level and what elements a CEA framework might contain. The analysis of the case studies was qualitative, focusing on the following themes: approach, process and method.

2.3 Research methodology

The third main element in the research approach is the specific methods of data collection and analysis. Flick (2002) has argued for the importance of research questions in qualitative research, particularly in the selection of data collection methods, formulating interview schedules and interpretation. In this research, the research questions guided the research methods used. The case study research strategy adopted for this research relies mainly on qualitative data collection and analysis techniques. However, in two components of the research, the EIS review and the first interview survey, a mixed method strategy is used, combining quantitative and qualitative methods.

The research methodology developed consisted of several stages which utilised several social science research methods including documentary review, semi-structured interviews and case study analysis. In evaluating the CEA framework and guidelines, a questionnaire was sent to planners, practitioners and experts. The research procedure is shown in Figure 2.1.

Figure 2.1 The research procedure



2.4 Literature Review

The main purpose of the critical review is to help the researcher develop a good understanding and insight into relevant previous research and the trends that have emerged (Saunders et al, 2000). The role of the literature review depends on the research approach. In the deductive approach, the literature helps in identifying theories which are tested using data while in the inductive approach, the literature helps to develop and refine further the research questions and objectives (Punch, 1998, Saunders

et al, 2000). The literature review has accomplished two functions in this research. Firstly, it allowed the identification of the research problem and research question on which this research is based and secondly it is the main source of knowledge regarding theories, methods and practice. The literature review consisted of four elements:

- CEA theory and practice
- Planning theory, the UK planning system and appraisal tools
- SEA theory and practice
- Urban regeneration policy, implementation and environmental issues

The review of literature on CEA was undertaken to identify trends in the development of research in this field. The review focused on definitions of cumulative effects, strategic models and frameworks for CEA and the network analysis method. Research on CEA practice has been reviewed to identify best practice, issues, processes and institutional structures for implementing CEA in other countries. International guidance on CEA have been analysed in terms of their applicability to the UK. CEA legislation and implementing regulations in the UK were examined and information on environmental planning and the UK planning system provided the background and context for CEA, to assess how CEA might fit into the planning and decision-making process. Government guidance documents relating to plan preparation were examined to determine government policy on cumulative effects. Literature on SEA and appraisal tools used in the UK informed the strategic dimension to this research.

Finally, after reviewing types of cumulative effects from the literature, it was decided to focus on those relating to space and time crowding effects. The review of CEA literature revealed that cumulative effects relating to urban areas have not been well explored. Most of the CEA studies carried out related to wetlands, parks and protected areas. This research project focused on effects relating to urban areas because it is where environmental problems are manifested most clearly (Kahn, 1986 cited in Colnett, 1991). Furthermore, urban environmental issues result mainly from the cumulative impacts from insignificant urban-based activities (Colnett, 1991). Within urban areas, the cumulative effects of urban regeneration became the focus because these are planned developments usually involving multiple components with potential for cumulative effects. Also, there are few studies on this area, particularly its environmental effects, since most urban regeneration literature has focused on social and economic issues. Subsequently, literature on urban regeneration was reviewed in

order to understand government policy, cumulative effects issues and what contribution CEA might have in planning for sustainable urban regeneration. It should be noted that the literature review was an on-going process throughout the research. The findings from the literature review comprise five chapters (Chapter 3,4,5, 7 and 8).

2.5 Establishing current CEA Practice

To understand the research problem better, reviews of documents relating to current CEA practice were carried out at project and plan levels. These consisted of: i) a review of 50 Environmental Impact Statements (EISs) of projects including other related documentation and ii) a review of 15 environmental/sustainability appraisals of development plans. The reviews were conducted to answer the specific research question: *To what extent and how were cumulative effects considered in environmental assessments of projects and plans?*

2.5.1 EIS Review

The EIS review was undertaken to examine the consideration of cumulative effects issues in EIAs prepared for a variety of project types between 1989 and 2000. Apart from the EIS itself, other documents reviewed were: planning statements, comments from consultees and other supplementary reports. The EISs were randomly selected from the DETR and Imperial College collection between March and July, 2000. Each EIS was reviewed against detailed criteria developed for the purposes of this research to ensure a systematic and standard approach. A detailed discussion of the EIS review and review criteria are contained in Chapter 6 and the list of EISs is included in Appendix 1. The findings from this review revealed that cumulative effect were inadequately considered in EISs. The review also identified issues in addressing these effects: the varied interpretations of the concept, the lack of adequate methodologies and the limitations of EIAs in mitigating these effects. The findings of the review were published as:

Cooper, L.M. and Sheate, W.R. (2002) Cumulative effects assessment: A review of UK environmental impact statements. *EIA Review* 22 (4): 415-439.

2.5.2 Appraisals Review

The review of EISs evaluated how these effects were considered in documentation provided at the development control process. However, in order to have a more

comprehensive picture of the extent cumulative effects are taken into account in the planning process, a review of appraisals of development plans was undertaken. To provide a context, the sample was taken from appraisals that were available in the Thames Gateway area between Spring 2001 and Summer 2002. The sample consisted mostly of sustainability appraisals of local or Unitary Development Plans, two county council plans and two regional plans (Greater London Authority and the South East Regional Planning Guidance). Detailed review criteria were developed to ensure a standard process. The findings from this review reveal the poor consideration of cumulative effects where only two appraisals mentioned cumulative effects and neither provided a detailed assessment. Details of the appraisals, review criteria and findings are discussed in Chapter 6.

2.6 Consultations on CEA Concepts, Issues and Options

The CEA activity researched here can be investigated through a study of documents, study of statements made by the actors or key players and the study of the process. In doing so, the findings from one type of study can be checked against the findings derived from another type, referred to by Punch (1998) as the logic of triangulation. The aim is to enhance the validity of the findings. In the next stage of the research procedure, some of the findings of the EIS review, such as the variety of interpretations of the concept of cumulative effects were compared against the findings from the interviews. This allows comparison of the 'objective' facts of the situation from documents to be compared with the interviewees' 'subjective' definitions of the situation (Flick, 2002).

Baxter et al (2001) suggested that the interview method is a very useful technique for collecting data, which would probably not be accessible using techniques such as observation or questionnaires. The interview approach was adopted rather than observations or questionnaires since the purpose was to explore concepts and choices within the context of planning. This follows Mason's (2002) observation that most qualitative research operates from the perspective that knowledge is situated and contextual and so the purpose of the interview is to ensure that the relevant contexts are brought into focus so that situated knowledge can be produced.

According to Punch (1998), the interview is a good way of accessing people's perceptions, meanings and definitions of situations and constructions of reality.

Interviewing can be structured, semi-structured, or unstructured. The choice of type used depends on how the deep the interview tries to go and the degree to which the interview is standardised across different respondents (Punch, 1998). A semi-structured interview approach was chosen rather than a structured interview so that in-depth interviews could be conducted. This technique is particularly suitable since some of the questions, such those relating to the concept of cumulative effects, needed to be explored and expanded more fully during the interview. However, an interview schedule was prepared for consistency, to increase the comparability of the data gained (Flick, 2002) and to ensure that all the questions are covered. The majority of the interviews were taped and transcribed as soon as possible while for some interviews detailed notes were made.

Twenty-eight government regulators, experts, planners, practitioners and statutory consultees were interviewed, using an interview schedule with open-ended questions. A copy of the interview schedule is included in Appendix 5. The aims of the interview were to: establish current understanding of cumulative effects; identify cumulative issues that could be addressed at various planning levels; investigate how cumulative effects could be better addressed in planning and how CEA could be integrated into the strategic planning process. The interviews provided valuable information on how CEA could fit into the planning system. The review of CEA literature suggested that cumulative effects issues would be better addressed at strategic levels. This view was reinforced by some interviewees who suggested that regional effects or gradual degradation from a range of activities couldn't be dealt with adequately on a project-by-project basis. The literature and interview survey therefore provided the answer to the specific research question:

> *What changes in the environmental assessment and planning process are necessary to ensure that CEA is applied effectively?*

Opinions were sought on various options on how CEA could fit into the strategic planning process. Most of the interviewees were of the opinion that introducing a new separate process would not be feasible and that it would be better to integrate CEA into an existing appraisal process, with a majority of the interviewees advocating the SEA process. Thus, the interviewees helped provide the answer to the specific research question:

How could CEA be integrated into the strategic environmental assessment and planning process?

The findings from the interview survey helped inform the development of a framework for integrating CEA into the SEA and plan-making processes. The findings from the interview survey are discussed in detail in Chapter 9 and a summary of these findings and a discussion of the proposed framework is published as:

Cooper, L.M. and Sheate, W.R. (2004) Integrating cumulative effects assessment into UK strategic planning: implications of the European Union SEA Directive. *Impact Assessment and Project Appraisal.* 21 (1): 5-16.

2.7 Development of the draft CEA framework

In some qualitative studies, the aim is to end up with a theory or model, developed systematically from the data collected. The process is inductive, building from the data broad or emerging themes to a generalised model or theory (Punch, 1998). The CEA framework was developed based on the information from the following sources:

- best practice for CEA: guidance, procedures and methods as identified in the literature review;
- review of CEA practice in the UK;
- semi-structured survey;
- SEA Directive and SEA Guidance (ODPM, 2002a);
- other government guidance such as Policy Planning Guidance Note 12 and sustainability appraisal guidance (DETR, 2000a); and
- findings from the macro-level case study analysis.

Emerging themes from the literature review, the review of CEA practice and the semi-structured interview survey reveal that there is a need for an appropriate framework and guidelines if CEA is to be effectively applied in the UK. Indeed, the findings from the interviews have identified the important elements of such guidance: explanation of the concept to facilitate understanding, a process for integrating CEA into the strategic environmental assessment process and methods which planners and practitioners can use with available data or one which does not involve extensive data collection. The *macro-level* case study provided a strategic perspective of cumulative effects issues,

particularly those relating to urban regeneration. All these different strands of the research informed the preparation of the framework. The preparation of the draft CEA Framework is discussed in detail in Chapter 9.

Based on these observations, it was decided to prepare the framework in the form of guidance, which would make it easier for potential users to apply and in terms of this research, it was felt that a guidance document might generate interest from those who were asked to evaluate it.

2.8 Evaluating and applying the draft framework

There were two elements involved in the evaluation of the framework: evaluation in the form of a questionnaire and application to case studies. These are discussed briefly in the following sections.

2.8.1 Evaluation questionnaire

The draft guidance was evaluated through a questionnaire which was sent to 33 respondents. The respondents consisted of planners, practitioners, statutory consultees and government regulators. Of these, 12 were previous interviewees who had been selected because of their role in the strategic planning process. However, the list of respondents was widened to include those involved in CEA, SEA and sustainability appraisals. The questionnaire consisted of two parts. In part 1, the respondents were asked two questions: i) whether the guidance was a useful contribution to the field of CEA and whether it could be used by planners and practitioners and ii) whether the guidance was clearly presented, easy to understand and logical. In part 2, the respondents were asked to comment on the specific sections of the guidance. A copy of the questionnaire is included in Appendix 7. Detailed comments were received from local authority planners, the ODPM, English Nature, Environment Agency and others. There were many useful comments and suggestions, which were taken into account in revising the draft guidance. The comments received and the resulting changes to the draft framework are discussed in detail in Chapter 11.

2.8.2 Case studies application

The framework was applied to the four sub-case studies, which were selected according to a set of criteria designed for this purpose (see Chapter 10). Case studies are bounded by time and activity and the researcher collects detailed information using a variety of

data collection procedures over a period of time (Stake, 1995). A case study protocol was developed which guided the data collection. The data collection methods used were the review of documents, interviews and site visits.

In the analysis, the approaches and processes used in the sub-case studies to address cumulative effects were compared with the proposed approach and process in the Draft Framework. The network analysis method was evaluated by asking consultees to comment on a network diagram prepared for that case study. The framework and network diagrams were subsequently revised in the light of those comments and suggestions. The case studies and findings from the application of the framework are discussed in Chapter 10 and 11.

2.9. The Final Framework

The draft framework was revised, taking into account the findings from the evaluation questionnaires and the application of the framework on case studies, to produce the Final Framework.

2.10 Criteria for judging the quality of research design

Yin (1994) suggested some criteria for ensuring the quality of the research design: internal validity, external validity and reliability. Internal validity refers to the internal logic and consistency of the research. To address this issue, Punch (1998) suggested 'member checking' which means taking the developing products of the research – its concepts, propositions back to the people being studied or who supplied the data for confirmation, validation and verification. In this research, the following steps were taken to address this issue: ensuring that the methods, approaches and techniques related to or measured the issues being explored, the framework guidance was sent to a number of those previously interviewed for validation and multiple sources of evidence were used (triangulation).

External validity or generalizability relates to the representativeness or transferability, whether the findings are likely to have broader applicability beyond the focus of the study. This issue is addressed in the discussion of the findings and the applicability of the framework to plans other than land use or development plans, such as local action plans or management plans, which might be required an SEA under the SEA Directive. It is worth noting that the framework has been applied to one of the sub-case studies,

which is a management plan, the Thames Estuary Flood Risk Management Plan. Furthermore, Surrey County Council in the SEA of its Mineral Plan has used the framework, following its distribution to consultees.

Reliability generally concerns the replicability of research findings and depends on how well the research process has been documented. This can be achieved through showing the audience as much as is possible of the procedures that have led to a particular set of conclusions. In this research, the chain of evidence has been presented, and the assumptions and criteria used in the various stages of the research have been documented.

2.11 Summary

This chapter has presented the methodology whereby the research problem and research questions were addressed. The following chapter reviews the published literature on CEA, identifying issues and themes.

SECTION II – BACKGROUND: CEA AND STRATEGIC PLANNING

Chapter 3. Cumulative Effects Assessment: Concepts and Approaches

3.1 Introduction

This chapter introduces the theory and practice of Cumulative Effects Assessment (CEA). The concept of cumulative effects is discussed in section 3.2. This is followed by theoretical and legislative origins of CEA in section 3.3. Subsequent sections focus on CEA definitions, the importance of CEA, principles and approaches.

Academic and practitioners' literature on the topic of CEA has been reviewed to identify trends and issues. The literature review has led to a series of themes for research and helped design the CEA framework proposed in this research.

3.2 Cumulative effects concepts

Cumulative effects are the combined, incremental effects of activities and there are various definitions of the concept that have been proposed. The US Council on Environmental Quality provides a definition of cumulative effects: *"... the incremental impact of the action when added to other past, present and reasonably foreseeable future actions... Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time"* (CEQ, 1978). This definition relates to two types of cumulative effects: i) impacts resulting from a particular action and other relevant actions and ii) impacts resulting from many small activities. The first type is usually addressed through project EIAs while the second one can only be addressed through strategic planning.

Since most experience of CEA has been carried out in EIAs, most definitions relate to the effects of a project which combine with the effects of other projects and become additive and persist in the long term detriment of the environment (Erickson, 1994; Ross, 1998 and Gilpin, 1995). The EC DG XI defines cumulative effects as *"Impacts that result from incremental changes caused by other past, present or reasonably foreseeable actions, together with the project"* (Hyder Consulting, 1999, p. 7). However, others take a broader view and suggest overall effects:

- "the totality of interactive impacts over time, i.e, the sum of incremental or synergistic effects caused by all current and reasonably foreseeable actions over time space" (Vlachos, 1985 p. 64) and
- "significant net effects of urban growth... that occur in an areawide geographical context, over a period of time" (Som *et al*, 1981, p.18 in Sonntag *et al*, 1987).

Other definitions refer to processes which result in cumulative effects: " *effects.. which occur so frequently in time or so densely in space that they cannot be "assimilated," or combine with effects of other activities in a synergistic manner*" (CEARC, 1988 in Canter and Clark, 1999, p. 1- 4) or as *"the accumulation of changes in environmental systems over time and across space in an additive or interactive manner"* (Spaling, 1994, p. 232).

Rees (1995) observed that there is no generally accepted definition of cumulative impacts but suggested that the concept consists of the following elements: the additive environmental impacts of a persistent agent over time and the gross (or net) environmental impacts of a number of activities. Canter (1999) identified some common themes in definitions of cumulative effects: the need to address multiple actions representing potential sources; consideration of pathways and receptors of impacts; and a recognition that such impacts may be additive, antagonistic or synergistic.

The concept of cumulative effects therefore involves multiple sources, pathways and impacts. Since this research is undertaken within a planning context, it takes the broader view of cumulative effects, which takes into account the impacts from multiple developments on the environment.

In order to further define this concept, typologies of cumulative effects have been developed. An early typology of cumulative effects issues was developed at the Canadian Environmental Assessment Research Council (CEARC) and the US National Research Council (USNRC) Workshop on Cumulative Environmental Effects, which is shown in Table 3.1. In this workshop, "nibbling", the incremental or decremental changes was recognised as the most important example of cumulative effects (Beanlands *et al*, 1986).

Table 3.1 Typology of cumulative environmental effects (CEARC/USNRC)

Type	Main characteristics	Examples
Time crowding	Frequent and repetitive impacts on a single environmental medium	Wastes sequentially discharged into lakes, rivers or watersheds
Space crowding	High density of impacts on a single environmental medium	Habitat fragmentation in forests, estuaries
Compounding effects	Synergistic effects due to multiple sources on a single environmental medium	Gaseous emissions into the atmosphere
Time lags	Long delays in experiencing impacts	Carcinogenic effects
Space lags	Impacts resulting some distance from source	Major dams; gaseous emissions into the atmosphere
Triggers and thresholds	Impacts to biological systems that fundamentally change system behaviour	Effects of changes in forest age on forest fauna
Indirect	Secondary impacts resulting from a primary activity	New road developments opening frontier areas

source: Sonntag et al, 1987.

The CEARC/USNRC typology is based on problems and issues. It very useful since it conveys some of the meanings of cumulative effects although some of the categories refer more directly to processes of accumulation (e.g. space and time crowding, compounding effects) than others (e.g. indirect effects) (Cocklin *et al*, 1992a). These authors noted that some types are mutually exclusive in that one type is unlikely to occur in the absence of another, such as time crowding and space crowding. They also questioned whether some types are cumulative (e.g. time lags and extended boundaries).

Other typologies were developed to describe issue types and their main characteristics, based on other perspectives (Beanlands *et al*, 1986 quoted by Barrow (1997); Peterson *et al*, 1987; Lane and Wallace, 1988; Spaling, 1994; and Therivel, 1992). Table 3.2 shows some typologies in terms of viewpoint.

This research focuses on types of cumulative effects in urban regeneration, which are due to space and time crowding. In the context of strategic planning, cumulative impacts of small developments and collective impacts of multiple developments as identified by Cocklin *et al* (1992a) are the main issues of concern.

Table 3.2 Classification of typologies

Typology	Viewpoint	Types	Examples
Beanlands, 1986 in (Barrow 1997)	process	- repeated incremental insults to the system; - actions that lead to system change or dynamic process; - accumulation of impacts by cycling over space and time	fundamental changes in system behaviour and structure – global climate change
Sonntag *et al* (1987)	process	- linear additive - amplifying or exponential effects; - discontinuous effects; - structural surprises	linear additive: addition of toxic substance to a lake
Peterson *et al* (1987)	functional pathways of accumulation	- additive and interactive pathways - compounding effects	additive pathway – persistent addition of wastes to disposal sites resulting in gradual addition of contaminants to groundwater system
Lane *et al* (1988)	drivers/motivation for assessment	- proponent driven – large projects that has multiple activities or multiple projects with multiple activities; - ecosystem driven – broad scale environmental degradation caused by many small activities or sudden event.	proponent driven – multiple devts in estuary ecosystem driven – acid deposition
Colnett (1991)	adapted from Petersen et al (1987) – functional pathways but focusing on urban issues and sources	-pollution and processes of industrialisation and urbanisation	habitat fragmentation from urbanisation urban air quality and airshed saturation from pollution
Cocklin *et al* (1992a)	sources of impacts	-multiple impacts of a specific development;	single devt- coal mine
		-collective impacts of the same type of developments;	windfarms
		-cumulative impacts of small projects that are outside the scope of the EIA process	small housing developments
		-collective impacts of multiple developments	urban regeneration strategy
Spaling (1994)	function and structure	-functional effects - structural effects - other types of cumulative effects indicative of the manner of accumulation	time dependent (time crowding and time lags); spatially oriented (space crowding , cross boundary movement or fragmentation); compounding, indirect and triggers

Several conceptual frameworks were developed to improve understanding of cumulative effects. Conceptual frameworks are usually based on a model of causality, including three elements (Spaling and Smit, 1993): cause or source of change, process of change, and result or effect. Causes refer to naturally occurring events or human-

induced actions, over time and space which contribute to cumulative environmental change. Processes and system structure include the receiving systems affected and the temporal and spatial processes influencing system response and recovery. Effects indicate the change in a system's structure and functioning over time and space. This conceptual framework of cumulative change is based on concepts and principles from environmental change theory, systems concepts and stress ecology (Spaling, 1994). Fundamental to this framework is a causal model which recognises a cause and effect relationship between perturbation and systems response.

An early conceptual framework for CEA was based on an input-output format and consisted of the three elements: activities, processes and effects (Horak *et al*, 1983 cited in Sonntag *et al* 1987). This model was further developed by Sonntag *et al*, (1987) through a systems matrix, which provides an analytical framework for CEA.

Further development of the causal model distinguished three main dimensions: sources of cumulative change, pathways of accumulation and impact accumulation (Cocklin *et al*, 1992a). Sources of change include single or multiple sources of disturbance. Pathways of accumulation include non-linear, synergistic and indirect or secondary processes. Impact accumulation can be categorised into two types: "accumulation of impacts", where a single or multiple developments result in a diversity of unrelated or unconnected impacts and an "accumulative impact" where developments or actions that may be unrelated but act in combination to affect the environmental component in additive, compounding and synergistic processes.

Thus, CEA can be guided by a causal based approach which recognises the components of sources, pathways and effects and characterises attributes of each component.

3.3 Origins of CEA

One of the ways in which cumulative effects can be considered is through the process of environmental impact assessment (EIA). Canter (1999a) defines the EIA process as the systematic identification and evaluation of the potential impacts of proposed developments. Wathern (1988, p. 6) describes the aim of the EIA process as "*...providing decision makers with an indication of the likely consequences of their actions*". Both definitions refer to potential impacts or consequences which includes cumulative effects. As Erickson (1994) argues, whatever legislative provision underlies

any defined process of EIA, concern over cumulative effects are implicit in the rationale of the assessment process as a tool for making decisions that affect the long term stability or quality of the environment.

The National Environmental Policy Act (NEPA) formally established the system of environmental impact assessment in USA in 1969. In 1970, the interim guidelines referred to the effects of many decisions about projects that can be "individually limited but cumulatively considerable" (Creasey, 2002). The 1978 regulations implementing NEPA required the assessment of cumulative effects of federal actions, which include projects, programmes, plans, policies, procedures and legislative proposals (CEQ, 1987). CEA was therefore required at both project and strategic levels of decision-making. To address environmental implications of policies and programmes, programmatic EIA, a form of SEA, has been used by federal agencies. Programmatic EIA has been use to assess impacts of actions similar in nature and broad in scope in which cumulative impacts are of concern (Sigal and Webb, 1989).

Following the US National Research Council and the Canadian Environmental Assessment Research Council workshop in the mid 1980s, there has been increasing interest on the subject (Sonntag *et al*, 1987; Petersen *et al*, 1987). In 1995, the Canadian Environmental Assessment Act required that the EIA process should include the consideration of "*any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out*" (Section 16(1)). More recently, the Guidelines for Implementing the Cabinet Directive on the Environmental Assessment of Policy, Plan and Programme Proposals suggested that cumulative effects should be considered in SEAs (CEAA, 2000).

The assessment of cumulative effects is specified in the EIA legislation of several countries. These include Australia (Court *et al*, 1994) and New Zealand (Dixon and Montz, 1995). In the European Union, the concept of cumulative effects has been present in environmental impact legislation since the first European Directive on EIA came into effect in July 1988. Annex III to Directive 85/337/EEC *on the assessment of the effects of certain public and private projects on the environment* (CEC, 1985) lists information to be supplied by the project developer in accordance with Article 5 (1a).

This includes a description of the likely significant effects of the proposed project on the environment, which should cover "*the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent, temporary, positive and negative effects of the project*". This Directive was originally implemented in England and Wales under the Town and Country Planning (Assessment of Environmental Effects) Regulations 1988, which refer to cumulative effects in Schedule 3 as optional information to be included in the environmental statement. Directive 97/11/EC, which amended Directive 85/337/EEC refers to "*cumulation with projects*" in Annex III and the amended England and Wales Regulations – Town and Country Planning (Environmental Impact Assessment) Regulations 1999 - lists cumulative effects alongside direct and indirect effects in the main text of Schedule 4 (Part 1).

Two other directives which require the consideration of cumulative effects are the Habitats Directive (Article 6.3) which states that an 'appropriate assessment' should be conducted when "*a plan or project is likely to have a significant effect on the site either individually or in combination with other plans and projects*" and the EU Directive 2001/42/EC (SEA Directive) on the assessment of certain plans and programmes on the environment which requires the consideration of "*likely significant effects....including cumulative and synergistic effects on the environment*" (Annex 1). These Directives require the assessment of cumulative effects at strategic level.

3.4 CEA definitions

Cumulative effects *assessment* (CEA, as opposed to cumulative effects) can be defined as the assessment of cumulative impacts of projects or actions, which include policies, plans and programmes. There are several definitions of CEA, reflecting the different levels it can be applied. A broad but comprehensive definition of CEA refers to "*the process of systematically analysing and evaluating cumulative environmental change.* " (Spaling and Smit, 1993, p.589). Cumulative change may come from either an individual activity that recurs over time and is spatially dispersed or multiple activities with linkages that result in accumulation.

Other definitions are more project or activity focused. Barrow (1995, p. 299) defines CEA as "*a type of assessment that seeks to identify and communicate the consequences of more than one impact from a single development or combination of impacts from a development interacting with impacts from other developments...* ".

Hegmann *et al* (1999, p. A1) define CEA as *"an assessment of the incremental effects of an action on the environment when the effects are combined with those from past, existing and future actions"*. In comparing CEA with EIA, these authors suggest that CEA assess effects over a larger area, over a longer period of time and focuses on valued ecosystem components.

These definitions suggest a basic feature of CEA: a systematic assessment of incremental effects from a single activity or multiple activities on the environment. The purpose of CEA is therefore to provide information on the overall impacts of an action. This is particularly important when the decision-maker is charged with assessing the public interest (Locke, 1994).

3.5 Rationale for CEA

There are three main reasons for CEA. Firstly, CEA broadens the focus of project level EIA; secondly, it addresses concerns not effectively taken into account in project based environmental assessment (Spaling and Smit, 1993, Fuller and Sadler, 1999); and thirdly, it is essential in the context of incorporating sustainability concerns (Barrow, 1997). At the project level, CEAs are expected to assess effects over a larger area than the site for which planning permission is sought and to assesses effects over a longer period of time than the project life. CEA enlarges the scale of the project assessment to a regional or area-wide level so that interactions and overall effects of the development on the environment can be better understood and set in a proper context.

However, as experience in environmental assessment has grown, some problems relating to CEA in EIA have been realised: major environmental impacts have resulted not from projects but from plans, policies and programmes and individually minor impacts not required EIAs can accumulate and have a significant effect over a wide area. Examples of these cumulative effects problems include increase in air pollution as a result of transport policy, gradual loss of open spaces due to housing, or deterioration of water quality as a result of urbanisation. These cumulative effects problems therefore require an assessment approach, which is broader in scope than the traditional EIA. In this context, CEA can be used as a planning tool where knowledge of the potential cumulative effects resulting from policies or plans would be useful to policy and decision makers. CEA approaches can be integrated into regional planning or land use studies where there are concerns about the effects of many proposed developments in an

area. CEA will be particularly essential where EIAs will not be required for those developments. These regional CEAs are usually undertaken before many actions begin in the region/area to inform area management plans and can be used to establish acceptable thresholds of change, which guide project specific assessments in the same region (Hegmann *et al*, 1999).

CEA plays an important role in the strategic environmental assessment process. Strategic environmental assessment (SEA) has been put forward as a method for assessing the effects of plans, policies and programmes. The potential role of SEA in addressing sustainability concerns by facilitating proper attention to cumulative effects has been widely recognised (Partidario and Clarke, 2000; Stinchcombe and Gibson, 2001).

CEA has the potential to be an additional tool to further environmental protection by extending EIA and SEA and contribute towards the aims of sustainable development. Rees (1988) noted that many known ecological problems (e.g. acid rain, ozone layer depletion) are the cumulative result of expanding economic activities and argued for regional sustainable development. Planning for sustainable development, however, requires systematic identification and monitoring of cumulative effects on important resources. Lawrence (1997) suggested that EIA has the potential to facilitate environmental sustainability and CEAs at project and strategic levels should receive particular attention in impact analysis. As Lane *et al* (1988 p1-1) argued, "effective management of cumulative effects... is the key to successful policy for sustainable development". Finally, the importance of CEA was recognised in the IAIA Effectiveness Study (Sadler, 1996), which identified the consideration of cumulative effects as one of the challenges relating to strengthening environmental assessment practice.

3.6 Principles

Although there are a number of definitions and concepts of cumulative effects, there are some basic principles that have been followed in most CEAs. Eight principles for conducting CEAs in the US were derived from the definition of "cumulative impacts" in the CEQ regulations, a survey of EIA practitioners and review of published literature (Canter and Clarke, 1999). These principles were designed to apply to CEA within EIA but are sufficiently generic so that they can also be applied to CEAs at strategic level.

Box 3.1 Principles of cumulative effects analysis (adapted from the Council on Environmental Quality, 1997).

Cumulative effects are caused by the aggregate of past, present and reasonably future actions. The effects of a proposed action on a given resource, ecosystem, and human community include the present and future effects added to the effects that have taken place in the past. Such cumulative effects must also be added to effects (past, present and future) caused by all other actions that affect the same resource.
Cumulative effects are the total effect, including both direct and indirect effects, on a given resource, ecosystem, and human community of all actions taken, no matter who has taken the actions. Individual effects from disparate activities may add up or interact to cause additional effects not apparent when looking at the individual effects one at a time. The additional effects contributed by actions unrelated to the proposed action must be included in the analysis of cumulative effects.
Cumulative effects need to be analysed in terms of the specific resource, ecosystem, and human community being affected. Analysing cumulative effects requires focusing on the resource, ecosystem and human community that may be affected and developing an adequate understanding of the state of the receptor and its susceptibility to effects.
It is not practical to analyse the cumulative effects of an action on the universe; the list of environmental effects must focus on those that are truly meaningful. For cumulative effects analysis to help the decision-maker and inform interested parties, it must be limited to effects that can be meaningfully evaluated.
Cumulative effects on a given resource, ecosystem, and human community are rarely aligned with political or administrative boundaries. Cumulative effects analysis on natural systems must use natural ecological boundaries and analysis of human communities must use actual socio cultural boundaries to ensure including all effects. However, this causes problems with mitigation and monitoring of effects since cumulative effects are not aligned according to administrative boundaries.
Cumulative effects may result from the accumulation of similar effects or the synergistic interaction of different effects. Repeated actions may cause effects to build up through simple addition (more and more of the same type of effect), and the same or different actions may produce effects that interact to produce cumulative effects greater than the sum of the effects.
Cumulative effects may last for many years beyond the life of the action that caused the effects. Some actions cause damage lasting far longer than the life of the action itself (e.g. acid mine drainage, radioactive waste contamination, species extinction). Cumulative effects analysis need to apply the best science and forecasting techniques to assess potential catastrophic consequences in the future.
Each affected resource, ecosystem, and human community must be analysed in terms of its capacity to accommodate additional effects, based on its own time and space parameters. Analysts tend to think in terms of how the resource, ecosystem and human community will be modified given the action's development needs. The most effective cumulative effects analysis focuses on wht is needed to ensure long-term productivity or sustainability of the resource.

The CEA approach adopted by both the US CEQ and the Canadian Environmental Assessment Agency relies on basic EIA principles and approaches already established. The Canadian Environmental Assessment Agency's Cumulative Effects Assessment Practitioners Guide (Hegmann *et al*, 1999) lists some basic requirements for a CEA:

- "assess effects over a larger (i.e., regional) area that may cross jurisdictional boundaries;
- assess effects during a longer period of time into the past and future
- consider effects on Valued Ecosystem Components (VECs) due to interactions with other actions, and not just the effects of the single action under review;
- include other past, existing and future (e.g., reasonably foreseeable) actions; and
- evaluate significance in consideration of other than just local, direct effects" .

3.7 Approaches

Since the concept of cumulative effects was introduced in the 1970s, two broad types of CEA have evolved: project focused and planning based. Spaling (1997) identified two distinct approaches to CEA. Firstly, CEA is an information gathering activity using principles of research design and scientific analysis to assist decision-makers. It is usually undertaken to fulfil the requirements of the EIA legislation and is project focused. Most CEAs have been conducted as part of a single project application for regulatory approval. The effects of a project are then the focus of the assessment and CEA considers the effects due to that project and other projects. It extends the temporal and spatial boundaries of the assessment and sets the assessment within the context of the wider area or region. An extension of project focused CEA may be the assessment of the cumulative effects of a cluster of projects, such as wind farms on adjacent sites or a number of commercial developments within an urban regeneration area. There are benefits to conducting CEA at project level. Baxter *et al* (2000) pointed out that project EIAs can address cumulative effects at the level of decision-making through project approvals and can reduce incremental contribution to cumulative effects. In addition, because of their scale, project EIAs can provide detailed, scientific analysis of impacts.

Secondly, CEA can use planning principles and approaches to assess the cumulative impacts of existing or proposed land uses and then ranks land allocation choices (Spaling, 1997). The objective is to assist decision-makers in systematically selecting a preferred choice and takes a more normative approach (Spaling and Smit, 1993). A planning approach to CEA has two important contributions: i) it provides the regional context for assessing the cumulative significance of activities in the area and ii) it can assess the cumulative effects from gradual, piecemeal environmental change caused by a number of individually small projects (which may not be subject to EIA). Where a number of developments have been proposed in an area or region, cumulative effects

studies are used as part of regional planning and initiated by public agencies. Examples of cumulative effects studies in Canada are the Banff-Bow Valley study and the Oak Ridges Moraine Planning study, which investigated the cumulative effects of activities on the environmental capacity of the region (Hegmann *et al*, 1999). Spaling *et al* (2000) noted, however, that those undertaking such studies seldom have the authority to implement their recommendations and manage cumulative effects.

Table 3.3 lists some differences in the two approaches. However, it is worth noting that the approaches are both based on the same conceptual framework, use similar methods, complement each other and are both essential for effective environmental management Spaling (1997).

Table 3.3. Comparison of approaches: project focused CEA and planning CEA

Aspects	Project focused CEA	Planning CEA
Focus	Impacts of project in combination with other projects in the area	Impacts of plan options, policies & proposals combined with impacts from other plans & actions
Purpose	Regulatory approval	Improve planning and assist environmental management
Context	EIA process	SEA and planning process
Strengths	Impacts can be quantified Involves a limited number of projects to consider, which reduces uncertainty Can address incremental impact of a project	Proactive, early in planning process Can address actions not covered by EIA regulations Can facilitate project EIA
Limitations	Cannot adequately address cumulative effects Mitigation measures limited	Analysis mainly qualitative Large number of variables Greater uncertainty
Responsibility	Project Proponent	Planning authority

CEA approaches have been classified according to focus: project analysis, regional analysis and ecosystem approach (Cocklin *et al*,1992a). Project analysis focuses on identifying the cumulative impacts associated with a particular development while regional analysis focuses on the full range of impacts within a spatially defined area. The ecosystem approach is a variation of the regional approach but the subject of concern is the ecological process. Regional ecological analysis has been proposed to facilitate planning (Cooper and Zedler, 1980; Beanlands and Duinker, 1984).

Several approaches/frameworks have been proposed for CEA. Contant and Wiggins (1991) proposed an approach for a project assessment while Damman *et al* (1995) proposed assessments at both project and strategic levels. Other approaches proposed were regional or area-wide in scope (Stakhiv, 1988; Cocklin *et al*, 1992a; Kalff, 1995). Irwin and Rhode's (1992) framework addressed the particular issue of boundaries. Table 3.4 sets out a summary of CEA approaches and frameworks.

Table 3.4 Comparison of CEA approaches and frameworks

Approaches	Application	Focus	Theoretical basis	Methods	Key elements	Benefits	Limitations
Stakhiv (1988)	general or regional wetland permits	decision-making	cause-effect theory, public choice theory,	linear programming techniques and algorithms; input-output analysis	specification of socio- economic objectives and physical constraints	model reflects economic-ecological interactions test trade-offs among objectives	problem of quantification and quantifiable data requirements
Contant and Wiggins (1991)	individual project	setting the context of development activities and natural systems	cause-effect theory	monitoring and modelling	effects from a project's relationship with other development activities and effects produced by an activity's presence in natural systems	provides an understanding of the context of a particular project; more thorough and rigorous analysis	extensive data requirements on past activities, socio economic parameters, time series data and other monitoring data
Cocklin *et al* (1992a)	regional	suitability of evaluation methods	environmental change theory	checklist procedure to provide a frame of reference GIS	structure for pairing human activities with changes in the environment; Spatial accumulation of impacts	good representation of spatial dimensions of effects; ease of communicating findings	digitised data requirements; data compatibility;
Irwin and Rhodes (1992)	programme evaluation, environmental management	temporal and spatial boundaries	cause-effect theory	series of questions; work with other organisations	boundary of key programme decisions cumulative effect boundaries	leads to action plan to identify and use more appropriate boundaries	focused on boundaries, useful as a preliminary stage rather than a full CEA
Kalff (1995) Developed by Kingsley (1997)	regional, park level	assessment of cumulative environmental change in national parks	environmental change theory	describe, map and identify economic growth patterns; cause-effect diagrams	regional analysis; tiered CEA- Plan and Project levels	interrelates different CEA analysis levels; provides for iteration among components identified cause-effect linkages	mainly qualitative
Damman *et al* (1995)	multiple projects; regional	impacts associated with land development process from multiple activities	cause- effect theory	regional analysis; modelling sub watershed approach	CEA levels: regional and municipal or sub area develop monitoring strategy	practical, uses available data relates to land use planning processes; use of professional judgement	Requires environmental data base Lack of available techniques for integrating impacts on valued resources from land use changes across all pathways.

As indicated in Table 3.5, Stakhiv (1988) proposed a model of CEA for wetlands permits, using a linear programming approach. The model abstracts and idealizes goals, physical constraints, decision objectives and interactions between human activities and the environment.

Contant and Wiggins (1991) produced an approach which emphasised the context of a particular project within a regional setting where monitoring and modelling of both development activities and natural systems are essential elements. With this analysis approach, cumulative impacts can be considered more thoroughly in project assessments.

Cocklin *et al* (1992a) advocated a CEA approach concerned with environmental change at the regional level. This regional CEA approach considered environmental change through time, extended scope and addressed interactions among human activities. The framework involved the application of two methodologies: a matrix during scoping stages and GIS for the spatial representation of cumulative effects.

To help environmental managers improve the way programmes address the cumulative nature of environmental problems, Irwin and Rhodes (1992) developed a framework to assist programme managers to compare boundaries of management decisions with the boundaries of cumulative impacts.

Another framework developed for environmental managers was developed by Kalff (1995) to assess cumulative effects in Canada's national parks. The CEA framework consisted of three subsections: sources of cumulative change, assessment of cumulative effects and management of cumulative effects. Assessment activities are conducted at three scales: (i) individual project level (ii) park level and (iii) regional level. Within these analysis levels, assessment steps have been specified which Kalff emphasises should be iterative. This tiered approach, further developed by Kingsley (1997), underlines this research project, which provides for tiering of CEAs of plans (See Chapter 9).

Practical frameworks using available data were proposed by Damman *et al* (1995) to assess cumulative effects of multiple activities. To be useful within land use planning, the framework had to be "*practical, understandable and capable of examining the*

impact of growth..." (Damman *et al*, 1995, p. 444). This type of approach was followed in preparing the Draft CEA Framework (See Chapter 9).

Damman *et al* (1995) proposed two frameworks: 1) Firstly, to assess the cumulative impacts from interactions among five mining projects in northern Saskatchewan. 2) Secondly, an area-wide CEA, which focused on assessing the cumulative impacts of multiple activities due to the land development process in the Oak Ridge Moraine area. This framework comprised two levels: Level 1 applied at regional level which prioritised sub-areas which required more detailed assessment; and Level 2 applied at the sub-areas. Damman (2002) noted that a CEA framework at a regional level could provide a mechanism for coordinating planning policies, but this requires recognising the benefits of a holistic approach to planning and decision-making. This in turn requires that the various planning authorities initiate a cooperative, collaborative and protective strategy for the area.

Finally, there are other frameworks which link CEA with a cumulative effects management system for the region. For example, the Cumulative Environmental Management Association in Alberta, Canada developed a framework for CEA which provides a common understanding of CEA and management among the different stakeholders (Spaling *et al*, 2000). A similar approach is the regional cumulative environmental assessment and management framework in the Northwest Territories, Canada, which was initiated to provide a regional context for land use planning and resource management decision making (NWT CEAM Working Group, 2000). In the UK, a regional CEA is the Liverpool Bay study was commissioned by the Countryside Council for Wales to develop a methodology for assessing cumulative effects of offshore industries from a nature conservation and landscape/seascape perspective as an aid to strategic planning (Oakwood Environmental Ltd, 2002).

3.8 Summary

This chapter discussed the concept of cumulative effects, origins of CEA, principles and approaches. The next chapter will discuss CEA process, methods and issues in CEA practice.

Chapter 4 CEA: Process, methods and practice

4.1 Introduction

This chapter discusses the stages within a generic CEA process. This is followed by a discussion of methods, focusing on those that are applicable to strategic CEA. The chapter concludes with an overview of trends in CEA practice and issues.

4.2 CEA Process

The organisation and ordering of steps of the CEA process may vary for different types of CEA. Lane et al (1988, p. 3-6) distinguished two processes: a "bottom up", inductive approach for proponent driven CEAs (single large project or multiple projects) and a "top down" deductive approach for regional CEAs.

Procedures developed for CEA consist of steps at each stage of the EIA: scoping, describing the affected environment and determining the environmental consequences. The US CEQ (1997) listed steps in CEA to be addressed in components of the EIA process as set out in Table 4.1.

Table 4.1 Steps in CEA to be addressed in components of the EIA process (CEQ, 1997)

EIA components	CEA Steps
Scoping	1. Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals. 2. Establish the geographical scope for the analysis. 3. Establish the time frame for the analysis. 4. Identify other actions affecting the resources, ecosystems and human communities of concern.
Describing the affected environment	5. Characterise the resources, ecosystems and human communities identified in scoping in terms of their responses to change and capacity to withstand stresses. 6. Characterise the stresses affecting these resources, ecosystems and human communities and their relation to regulatory thresholds. 7. Define a baseline condition for the resources, ecosystems and human communities.
Determining the environmental consequences	8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems and human communities. 9. Determine the magnitude and significance of cumulative effects. 10. Modify or add alternatives to avoid, minimise or mitigate significant cumulative effects. 11. Monitor the cumulative effects of the selected alternative and adapt management.

The Canadian Environmental Assessment Agency (CEAA) guide also proposed a similar process, composed of tasks to complete for a CEA within the EIA process. It should be noted that both these guides focused on CEAs relating to single developments but the process could be adapted to strategic CEAs. The CEA process for regional/plan

CEAs is conceptually similar to the traditional EIAs (Kalff, 1995; Kingsley, 1997). The steps in the process are discussed below.

4.2.1 Scoping

Scoping establishes the focal point of the assessment at the start and "failure to do so severely limits the probability of obtaining useful and credible results" (Beanlands, 1988 p. 33). Scoping stage is crucial since it narrows down all the potential environmental impacts so that the assessment focuses on the key issues, is manageable and practical (Hegmann *et al*, 1999; Jones, 1999). It is used to determine whether the resources, ecosystems and human communities of concern have already been affected by past or present activities and whether other agencies or the public have plans that may affect those resources (CEQ, 1997).

Scoping should involve all stakeholders and provide a means by which the public can help define the concepts that become the formal requirements for the assessment (Beanlands, 1988). Scoping should be used "to identify the attributes of environmental components for which there is public concern and upon which the EIA should be focused" (Beanlands and Duinker as quoted in Beanlands (1988, p. 34). Since CEA requires assessing a broad range of environmental concerns, it is particularly important that the assessment remains focused on key issues. Hegmman *et al* (1999) therefore suggested that only those issues that will influence the decision-making should be considered.

A transparent, thorough and considered relationship between the responsible authorities and proponents is critical in scoping (Scase, 2002, Barnes et al, 2002). Public involvement is a key component of CEA but as Canter (1999) cautioned, the analytical nature of the exercise should not be lost.

Therefore, scoping for CEA is concerned with identifying regional issues of concern; selecting appropriate regional valued ecosystem components; identifying appropriate spatial and temporal boundaries; identifying other projects or plans that may affect the same valued resources and identifying potential impacts. Canter (1999) suggested that the focus of scoping should not be limited to physical (chemical and biological) features of the affected environment but should also include socio-cultural and socio-economic issues.

Scoping for CEA at project and strategic levels vary considerably in terms of issues, boundaries and other actions to consider. For project EIAs, scoping aims to identify area-wide/regional context so that the potential contribution of the project's effects can be assessed. For strategic CEA, the context can be "bio-regional in scope, but can be extended to larger, cross regional effects" (Sadler and Verheem, 1996, p.153). In planning for sustainability, a systematic assessment of cumulative impact trends in significant environmental variables carried out on a regional basis is required (Rees, 1988, p. 284). Thus, in scoping, the variables to be considered, the scale of the assessment and methods that will be used need to be decided. The challenge in scoping, however, is focusing the analysis on the effects that clearly demonstrate potential to create a cumulative impact (Scase, 2002).

4.2.2 Describing the affected environment

CEA requires an appropriate description of the current environmental setting, which is the condition of the physical and social environments before the projected implementation of the proposal (Erickson, 1994). This before and after comparison of the environment is the heart of the assessment process (Ibid, 1994). The CEQ guide (1997) suggested that the baseline conditions provide the context for evaluating the environmental consequences and should include information on historical cumulative effects. It specifies what describing the affected environment includes (see Table 4.1). The baseline conditions should be described in a geographical extent that is sufficiently large to account for all project-environmental interactions and the period of time long enough to include all the mediated impacts. For strategic CEAs, the baseline data required to assess certain impacts, such as air pollution, may extend beyond the plan area.

The baseline should include other actions that are contributing to cumulative effects. Contant and Wiggins (1992) suggested the use of monitoring data to identify and track development actions over time and time series data, which provide a database for understanding the natural system's responses, thresholds and interactions. However, several researchers have noted the scarcity of data needed for CEA (Duinker, 1994; Glasson et al, 1994; Burris and Canter, 1997; Cooper and Canter, 1997; Piper, 2000). To address this issue, Damman et al (1995) proposed an alternative practical framework, which uses existing environmental data bases.

4.2.3 Determining the environmental consequences

The analysis of environmental consequences should focus on the selected resources. This stage consists of the following: identifying the important cause-effect relationships; analysing and predicting cumulative effects; evaluating its magnitude and significance and proposing mitigation and monitoring programmes.

4.2.3.1 Analysis of effects and significance

The analysis of effects involves predicting the nature, duration and magnitude of the cumulative impacts an action (project proposal, plan or programme) will have on the baseline environment. The CEA should consider the full range of impacts including direct, indirect and higher order impacts in order to identify the total impacts, which constitute the cumulative effects. These cumulative effects could be in the following forms: additive, synergistic, threshold and saturation, induced and indirect, time-crowded or space-crowded (Therivel et al, 1992).

Several authors have noted problems in assessing cumulative effects: accuracy is problematical, technically difficult and uncertainty due to complexity of systems (Erickson, 1994; Barrow, 1997; Noble, 2000). These authors stress, however, that although real constraints are imposed on the assessment, these should not preclude the responsibility to undertake the assessment.

Although referring to EIAs, Shepherd (1998) observed that EIAs tend to do best in predicting the direction but not the magnitude of change associated with major direct impacts and that indirect and cumulative impacts are predicted less accurately. A practitioner survey of CEA revealed that respondents found the identification of processes of accumulation for additive impacts "easy" but synergistic impacts "moderately difficult" and interactive impacts "difficult" (Burris and Canter, 1997 p188). Another survey of EIS professionals in the US found that cumulative effects were addressed in about one-half of the EISs that they were familiar with (Cooper and Canter, 1997 p. 17). Additive impacts were perceived to be easier to address than synergistic or interactive ones. The respondents also indicated that the process of accumulation is an important issue in addressing cumulative effects and that the process can become complex, thereby limiting quantification opportunities.

A range of techniques can be used to predict and analyse impacts: checklists, matrices, network and systems diagrams, expert judgement, GIS and modelling. The particular approach and methodology employed in CEA depends on the objectives of the assessment, the nature and distribution of developments being considered and the types of effects being assessed (Bonnell and Storey, 2000). Qualitative methods include professional judgement, matrices and network diagrams. Erickson (1994) maintained that prediction could be appropriately addressed by gathering together the information, insight and judgements that have been thoroughly examined in order to inform the decision-making process.

Some researchers have suggested the use of network and systems diagrams for conceptualising cause and effect relationships (Lane et al, 1988; CEQ, 1997). Such diagrams can assist in identifying past, present and future actions that should be considered in the analysis.

Both qualitative and quantitative methods can be used in the analysis of effects. Cooper and Canter (1997) suggested that quantitative methodologies should be used as much as possible, especially simple models and indices. They noted that most EIA practitioners wished to use quantitative or technical methods of predicting cumulative effects, but these are not always practical or feasible.

Once the important cause and effects pathways are identified, the next step would be to determine the magnitude of the cumulative effects resulting from all the actions included in the analysis. The cumulative effects on a specific resource will not necessarily be the sum of the effects of all actions (CEQ, 1997). Knowing how a resource responds to change (cause-effect relationship) is essential in determining the cumulative effects of multiple activities. Thresholds and other criteria (levels of acceptable change) can be used to determine the significance of effects. Significance criteria can be qualitative, such as perceptions of the affected community or quantitative, such as water quality or air quality thresholds.

4.2.3.2 Mitigation

In general, mitigation measures to address effects include avoidance, reduction, restoration, compensation, modification of the proposal and selection of alternatives. Hegmann *et al* (1999) suggested that mitigating local effects is one way of reducing

cumulative effects but to be effective, mitigation must be long term, area-wide or regionally based. However, the ability of project EIAs to mitigate cumulative effects is limited since it can only mitigate that project's effects. To be able to mitigate cumulative effects effectively, these issues need to be addressed at a higher planning level. For example, policies or proposals in plans could be formulated to avoid developments in certain areas or noise limits can be set in an area where construction noise from multiple developments is likely to be cumulative. For certain cumulative effect problems, such as regional air pollution, policies and programmes at regional level may be required to address the problem.

The US CEQ Guide (1997) suggests that by analysing cause and effect relationships that result in cumulative effects, strategies to mitigate or enhance resources could be developed. In developing mitigation measures, the key is to determine which of the cause and effect pathways results in the greatest effect and measures that focused on those pathways would be the most effective (Ibid, 1999).

4.2.3.3 Monitoring

Monitoring has been defined as the repetitive measurement of indicators to be able to anticipate and provide a better understanding of spatial and temporal changes in environmental quality (Rennick, 1994). Shepherd (1998) argued that monitoring is important for the following reasons: (i) it determines whether proposed mitigation measures have been implemented and whether they were effective (ii) monitoring compares the actual effects of a project/plan to its predicted effects and (iii) monitoring improves project/plan outcomes through adaptive environmental management.

Monitoring actual interactions over time should improve understanding of relationships and processes in the environment (Mitchell, 1989). For example, monitoring of the physical-biological environment can establish baseline conditions and indicate the nature and extent of environmental stress and response and provide a context (Contant and Wiggins, 1991; Cocklin *et al*, 1992a). Monitoring is important for CEA in order to establish trends relating to the valued resources.

Knowledge of natural and scientific processes is limited and a monitoring programme can produce objective and accurate information that will be useful to the CEA (Cooper

and Canter, 1997). However, in their study of substantive issues in CEA, they noted that only a third of studies included monitoring.

Important components of a monitoring programme include: setting goals; identifying units (ecological, natural or social) and time and spatial boundaries; selecting measurable indicators of the magnitude and direction of environmental change; means of assessing causality; means of measuring effectiveness of mitigation; selecting measures to determine significance of data collected; and provisions for adaptive management.

4.2.3.4 Management

Several researchers in CEA have promoted the use of adaptive management (Holling, 1978; Sonntag et al, 1987; Lane et al, 1988; Mitchell, 1989, 1997; Noble, 2000). Noble (2000) argued that the three main difficulties of EIA (accuracy of prediction, effectiveness of mitigation measures to reduce impacts and efficiency and fairness of the assessment process) could be addressed through the application of adaptive management principles. Adaptive Environmental Assessment and Management pioneered by Holling et al (1978) focuses on finding ways to make better decisions and working out how systems analysis and methods could be used to overcome some of those problems. For CEA, which deals with complex and dynamic systems, where problems of uncertainty are greater, adaptive management has much potential.

There are uncertainties in predicting impacts from particular developments; predicting developments likely to occur in the future; predicting the effect of new impacts on ambient environmental quality and predicting secondary and interactive impacts (Buckley, 1998). Scientific uncertainties relating to synergistic or interactive impacts are likely to be greater than those for additive effects (Cooper and Canter, 1997).

Hegmann *et al* (1999) considered that uncertainty in prediction and determining significance could arise from several factors: variations in natural systems, lack of information or knowledge about cause-effect relationships or inability of models to represent complex systems. They noted that the degree of uncertainty in addressing cumulative effects is greater than other project impacts because of the larger study area and longer time horizon. They recommend the following measures to deal with

uncertainty: use precautionary principle; document assumptions, data gaps and methods; recommend mitigation to reduce effects and monitoring.

4.3 Methods for CEA

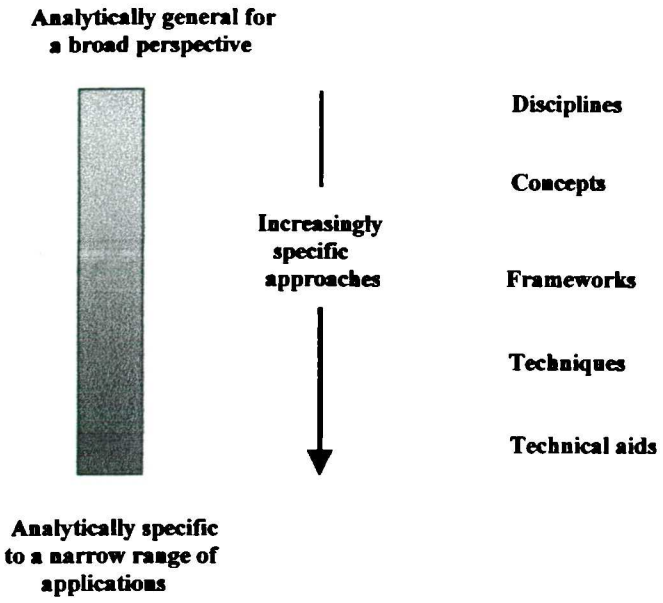
A variety of methods are available to identify and assess cumulative effects. Lane et al (1988, p. 3-6) argued that for each step, there may be several specific methods that can be used and that there is no right method for any particular step. Methodological tools used in EIA can also be used in CEA but as Smit and Spaling (1995) point out, the broader perspective of CEA requires other methods such as regional planning, threshold indicator analysis and linear programming.

Several authors have developed various ways of classifying these methods and criteria for evaluating them. Based on existing methodologies at that time, Sonntag et al (1987) classified CEA methods into: matrix methods, causal analysis, adaptive management and systems modelling.

Taking the view that CEA is more compatible with comprehensive planning than regulatory decision-making, Stakhiv (1987) categorised CEA methods based on evaluation and decision-making perspective: (i) valuation methods (qualitative and numerical criteria) (ii) linked deterministic and simulation models (mass balance and input-output techniques) (iii) unified holistic theoretical approaches (economic based) (iv) land use designation approaches (zoning).

Hegmann and Yaranton (1995) classified CEA tools as shown in Figure 4.1. They noted that the distinction between the five classes do not appear to be distinct for certain tools but pointed out that different tools have different degrees of practical use.

Figure 4.1 CEA tool class continuum



Source: Hegmann and Yaranton (1995 p 59)

In this categorisation, disciplines and concepts guide the CEA framework. Under this class are EIA/CEA techniques or methods which are categorised into:

- information organisers (matrices; networks; feedback loops; overlays and time series pictures) and
- analysis techniques (hypothesis-evaluation process; indicators; indices of environmental quality; multivariate analysis; simulation modelling).

Hegmann and Yaranton's classification is based on what the tool can do in actual practice. An alternative classification of CEA methods is based on their capacity to identify and document the nature and extent of cumulative effects. Spaling and Smit (1995) classified methodological tools according to approaches:

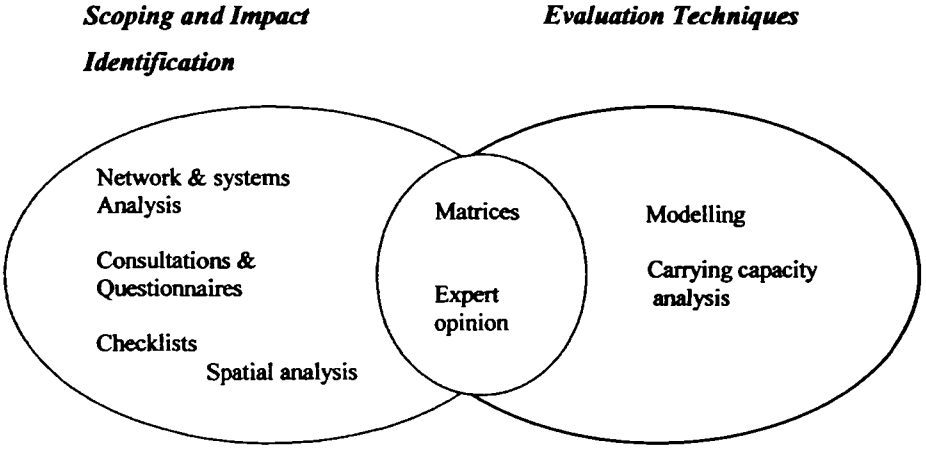
- analytical approaches (spatial analysis; network analysis; biogeographic analysis; interactive matrices; ecological modelling; and expert opinion) and
- planning approaches (multi-criteria evaluation; programming models; land suitability evaluation and process guidelines).

CEA methods have been classified into two types: primary and special methods. The latter includes carrying capacity analysis, ecosystem analysis, economic and social impact analysis (CEQ, 1997). Three sets of criteria were used to evaluate these methods:

- consideration of the nature of effects, characteristics and interactions
- capacity to quantify, synthesise effects, suggest alternatives, serve as a planning or decision-making tool
- whether the method is validated, flexible, reliable and repeatable.

The European Commission's *Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions* (Hyder Consulting, 1999, p 14) classified the methods into groups: scoping and impact identification, and evaluation. Some methods can be used in both phases as shown in Figure 4.2.

Figure 4.2 Methods for CEA (Hyder Consulting, 1999, p14)



Hyder Consulting (1999) specified uses of the above techniques:

- Scoping and impact identification techniques – these identify how and where a cumulative effect would occur
- Evaluation techniques – these quantify and predict the magnitude and significance of impacts based on their context and intensity

Several researchers have identified criteria for evaluating methods used in CEA. Spaling and Smit (1995) evaluated these methods in terms of the following criteria: ability to consider multiple perturbations, additive and interactive pathways of accumulation and different types of cumulative effects. They concluded that GIS, landscape analysis and simulation modelling are useful methods while loop analysis and cause-effect diagrams are mainly heuristic tools.

Dixon and Montz (1995) suggested that methods should be able to represent interactions, incorporate impacts as they occur spatially and temporally and trace not only direct impacts but also higher order impacts. On the practical side, Damman *et al* (1995) indicated that these methods should be 'doable' and based on available information and resources.

In practice, Cooper and Canter (1997) found that the method most frequently used by practitioners was professional judgement followed by checklists, models, case studies, indexes, network diagrams and interaction matrices in order of utilisation. Professional knowledge/judgement was considered the most important and useful method followed by models. They concluded that most of the methods used were qualitative. They concluded that quantitative methods might be difficult to use because of cost, time and data limitations.

However, as Wathern et al (1986) demonstrated in the case of the River Ebbw in Wales, the use of quantitative analysis methods, such as cumulative sum analysis, can be useful in quantifying the effects of any observed change in water quality and assessing the effects of policy, which led to changes in the characteristics of the river.

Quantitative methods can be useful in communicating findings to decision makers but can only be undertaken when there is quantitative data available. In general, CEA methods are able to consider spatial dimension more frequently than temporal aspects (Sadler and Verheem, 1996). They suggested that for a comprehensive CEA a mix of methods is appropriate. Therefore, a CEA may begin with a method useful for conceptual understanding (cause-effect analysis). This can be followed by other more comprehensive and analytical approaches, such as landscape analysis or simulation modelling. Results from this can be evaluated using multi-criteria or land suitability methods to assist decision-making.

4.4 Trends in CEA Practice

Although the terms cumulative impacts or effects were used in EIA legislation, regulations and guidelines in several countries in the 1970s, it was not until the mid to late 1980s that these effects began to be considered in EIAs (Canter, 1999). Research papers relating to aspects of CEA were published during the 1970s and early 1980s (for example, Holling, 1978; Leopold, 1981; Beanlands and Duinker, 1983). Interest in the

the subject increased after the publication of the findings from the workshop on Cumulative Environmental Effects: A Bi-national Perspective (CEARC and NRC, 1986) and this continued until the 1990's, as more research papers have been published. A reading of the papers and documents identified the main themes covered: concepts and frameworks; development and application of methods; delineating boundaries; institutions and implementation; monitoring and management and effectiveness of process.

From the early 1990s to 2002, the focus of papers has slightly shifted from those dealing with concepts and assessment to cumulative effects management. While initially papers explored concepts (for example, Spaling and Smit, 1993; Spaling, H, 1994; Ross, 1994 and Duinker, 1994), more recent papers deal with the management of these effects (such as Creasey, 2002; Spaling et al, 2000). The emphasis on the scope of CEA has also slightly altered, from project based CEA to regional cumulative effects management. For example, recent papers discuss management approaches and frameworks (Damman, 2002; Klym et al, 2002 and Davey et al, 2002)[1].

A recurrent theme in the literature has been the recognition that these effects are not easily addressed within project level impact assessments (Graham Smith, 1993; Gilpin, 1995; Barrow, 1997) and that these effects are better considered at a strategic level through SEA (Therivel et al, 1992; Sadler, 1996; Therivel and Partidario, 1996; Bonnell and Storey, 2000, Partidario and Clarke, 2000). More recently, the links between CEA and sustainability have been explored (Stinchcombe and Gibson, 2001), which may indicate the future development of CEA.

4.5 CEA Practice Issues

Several issues regarding CEA practice were identified in the papers and documents examined which revolved around the following themes: concepts of cumulative effects and CEA; limitations of project EIA; many small individual actions not requiring EIAs but could result in significant effects and process related issues: boundaries, other actions, significance, tools and institutional aspects.

[1] The themes of these papers may have reflected the subject of conferences on CEA - Cumulative Assessment in Canada: from Concept to Practice in 1994 and Cumulative Effects Management: Tools and Approaches in 2000.

4.5.1 Understanding of the Concept

As discussed in section 3.2, there is a range of definitions of cumulative effects. Definitions and concepts of cumulative effects vary in focus and scale so that some relate to project effects while others refer to regional or even global effects. Clearly cumulative effects encompass a range of meanings. For example, in a survey of 50 UK EISs (undertaken as part of this research and reported in Chapter 7), EIA practitioners defined cumulative effects in a variety of ways, such as the interaction of impacts of the project or the effects of the development elsewhere (Cooper and Sheate, 2002). There is also the problem of understanding of the concept which may be due to the nature of the concept itself and to some extent to the lack of definition in EIA legislation. In the semi-structured interview survey conducted as part of this research (see Chapter 9), the findings showed that levels of understanding of the concept among those interviewed were generally poor (Cooper and Sheate, 2004). A parallel study conducted by the Environment Agency also showed that the level of understanding of what cumulative effects are and how they can be assessed is low both within and outside the Agency (Environment Agency, 2003).

4.5.2 Limitations of project EIA in addressing cumulative effects

How to address cumulative effects in projects has been the focus of earlier work in CEA (Lawrence, 1994; Ross, 1994) and guidance published (CEQ, 1997; CEAA, 1999; Hyder, 1999). However, much of the CEA literature highlights the inadequacies of a single project level assessment to fully address or mitigate cumulative impacts arising from it and other developments within the area. Spaling and Smit (1993, p. 597) argued that "with a site focus, the spatial and temporal scope, long term processes and cross boundary movements are constrained". Furthermore, project EIAs usually focus on single developments while many problems of environmental deterioration, resource management and multi-user conflicts are broader in scope (Lane et al, 1988; Fuller and Sadler, 1999).

Apart from limitations in scope, there are other problems in addressing cumulative effects in EIAs. Firstly, a proponent's ability to identify, quantify and evaluate the effects of other projects and activities may be severely limited by the availability of information and resources (Davey et al, 2002). Secondly, there is also the problem of mitigating cumulative effects, since proponents can only mitigate the effect from their development. Cumulative effects mitigation requires a broader approach than is usually

proposed in project based assessments (Baxter et al, 2000, Creasey, 2002). As Kennet (2002) argues, the measures required to address overall cumulative effects are not within the proponent's control. He suggests a government driven approach to CEA with government providing the baseline data and analysis required for CEA as well as dealing with issues relating to mitigation, monitoring and management.

These weaknesses in EIAs suggest that cumulative effects are likely to be dealt with more effectively at a strategic level, with a wider focus and scope and where minor impacts and impacts from many developments can be considered more thoroughly. Cumulative effects are more easily understood within a wider land-use planning framework (Sabatini et al, 1989). SEA has been developed as a means through which cumulative effects could be addressed (Therivel, 1992; Therivel and Partidario, 1996; Barrow, 1997; Partidario and Clarke, 2000). Furthermore, SEA facilitates a planning approach to addressing potential cumulative effects at various stages of decision-making (Bonnel and Storey, 2000). By assessing the impacts of plans and programmes, the overall significance of minor impacts that could result from policies and proposals can be taken into account. The following sections will briefly discuss issues relating to process.

4.5.2 Delineating spatial and temporal boundaries

The setting of boundaries is one of the issues widely discussed in the literature and one of the initial problems in undertaking a CEA. Beanlands and Duinker (1984) argued that the setting of space and time boundaries for an EIA is critical to study design and interpretation of results for EIAs and suggested the following criteria: project boundaries, political or administrative boundaries, ecological boundaries and technical boundaries (e.g. limited understanding and logistical difficulties). Wright and Greene (1987) proposed boundaries focused on environmental components and suggested that the following factors be considered:

- possible adverse effects,
- probability of occurrence of an event, and
- public perception of potential environmental effects.

Irwin and Rhodes (1991) identified some barriers to selecting appropriate boundaries: institutional (i.e., lack of legal authority or clear focus on issues) and technical (i.e. lack of data and models and limited understanding of environmental processes). Some of

these difficulties in defining boundaries were identified in Burris and Canter's (1997) survey of EIA practitioners, which also indicated that spatial boundaries are included more often than temporal ones.

4.5.2.1 Spatial boundaries

There are two schools of thought regarding spatial boundaries. Baskerville (1986, p.10) presents a scientific view of CEA where the first step in bounding the geographical area for the study is to *"define the nature of subunits within the total area, so that the sensitivity of forecasts to processes can be appropriately reflected in the overall assessment"*. Westman (1985, p. 39) takes an environmental planning perspective and suggests that EIAs should evaluate cumulative effects *"within the context of regional plans that have assessed the carrying capacity of the region's resources for the cumulative impacts of proposed actions"*. The CEQ report incorporating biodiversity considerations into EIA recommends that agencies look beyond site level effects and assess impacts within an ecosystem, landscape or broader regional context (CEQ, 1993 cited in Clark, 1994). Appropriate spatial scales are at the watershed, airshed or ecosystem level but these geographical boundaries may not match administrative ones (Clark, 1994; Irwin and Rhodes, 1991).

These boundaries would depend on the resource and represent appropriate regional context for that resource. Cocklin *et al* (1992a) proposed four approaches to spatial boundary definition:

1. use of existing administrative units;
2. boundary definition on the basis of ecological/physical/environmental characteristics;
3. delineation of boundaries with reference to human activity patterns or communities of interest;
4. some combination of 1-3.

As these authors point out, existing institutional boundaries are often a result of incremental and other decisions over a period of time and may not have relevance in terms of environmental terms but may establish spatial patterns of environmental management.

The US CEQ (1997) and the Canadian Environmental Assessment Agency (Hegman *et al*, 1999) guides suggested some criteria for establishing spatial boundaries, which related to impact pathways:

- Establish local and regional study areas to include interactions with other actions
- Use several boundaries, one for each valued resource;
- Boundaries should expand sufficiently to address cause-effect relationships between actions and valued resources;
- Characterise the nature of pathways that describe cause effect relationships to establish a 'line of inquiry' to determine where these effects become insignificant.

Clark and Leppert-Slack (1994) suggested that spatial boundaries should be defined in relation to the distance the environmental effects occur, regardless of the geographical boundaries crossed. Some authors have suggested that different spatial and temporal boundaries may be appropriate for different types of effects and that larger geographic and temporal boundaries currently used in environmental assessments are required for CEA (Irwin and Rhodes, 1991, Drouin and Le Blanc, 1994 and Erickson, 1994). Moreover, how broadly the analysis is bound depends on both ecological principles and practical considerations (Bedford, 1999).

4.5.2.2 Temporal boundaries

The concept of a temporal dimension is inherent in definitions of cumulative effects. For example, Ross (1994 p5) suggested that "*cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time*". Sonntag (1987, p. 5) also referred to cumulative effects as impacts which "*occur so frequently in time..*". Spaling and Smit (1993, p. 589) refer to cumulative environmental change or cumulative effects as "*the phenomenon of temporal and spatial accumulation of change in environmental systems...*". The CEQ regulations defined cumulative effects as the "*incremental impact when added to other past, present and reasonably future actions...*" (40 CFR 1508.7, CEQ 1978).

Past actions

The issue is how far back to go in establishing the historical boundary and how far into the future to go in designating the time period. Experts have long discussed this issue but as Canter (1999) observed, there are no precise guidelines. From their survey of

EIA practitioners, Burris and Canter (1997) noted some difficulties in establishing such boundaries: e.g. defining where short-term ends and long term begins, lack of historical data, correlating past and current data and taking account of the fact that spatial boundaries may shift over time.

Hegmann *et al* (1999) suggested the use of scenarios, where specific scenarios represent a point in time with specific disturbances and environmental conditions. Incremental changes between scenarios can be compared to assess the relative contribution of the actions to overall cumulative effects within the regional study area. Hegmann *et al* (1999 p. 16) proposed the following options for establishing past boundaries:

- *"when impacts associated with the proposed action first occurred;*
- *existing conditions;*
- *the time at which a certain land use designation was made;*
- *the point in time at which effects similar to those of concern first occurred;*
- *a past point in time representative of desired regional land use conditions or pre-disturbance conditions"*

In the survey of 12 EIAs in Canada, Baxter *et al* (1999) concluded that past impacts were inadequately identified in many of the CEAs reviewed and this deficiency contributed to an insufficient depiction of the affected environment. These findings reflect those of McCold and Holman (1995) who reviewed 89 EAs prepared in the US where only five EAs identified other past, present and future actions by other persons and agencies.

Availability of data often determines how far back past effects are examined (Cocklin et al, 1992; CEQ, 1997). Consequently, empirical analysis will be focused largely on the present and on predicting future changes. The assessment should consider the extent to which the effects of development are already accumulating in the area and the degree of control that authorities have had in managing this area in the past (Beanlands, 1985).

Future actions

There are three types of future actions: *certain, reasonably foreseeable* (action may proceed but there is some uncertainty as to its conclusion) and *hypothetical* (there is uncertainty whether the action will ever proceed) (Hegmann *et al*, 1999).

In the survey of 12 Canadian CEAs, Baxter *et al* (1999) found that identification and full incorporation of future developments was a problem in the CEAs. These authors suggested that the vague language and requirement of the CEA Act contributed to the problem. In Cooper and Canter's (1997) survey on the substantive issues in CEA, the respondents identified a number of difficulties associated with defining temporal boundaries, particularly those relating to "reasonably foreseeable future action" (RFFAs). According to Rumrill and Canter (1997), information gathering and analysis related to RFFAs may be the most difficult aspects of addressing cumulative impacts within the EIA process. As a result, over 40 court cases in the US have involved cumulative impacts and many of these have hinged on RFFAs.

Potential impact-causing activities and disturbances vary in time and duration and some effects may extend beyond the completion of project abandonment, before recovery is complete (Conover et al, 1985). Thus, future boundaries for cumulative effects could extend beyond the end of the project or plan. With regards establishing future boundaries, Hegmann *et al* (1999, p.16) suggested the following options:

- "end of operational life of the project;
- after project abandonment and reclamation;
- after recovery of VECs to pre-disturbance conditions"

4.5.3 Assessment of significance

One of the major challenges in CEA practice is how significance is determined. Guidelines in CEA have suggested various ways to determine significance: using a series of questions relating to context or values, thresholds, capacity or acceptability. The Canadian Practitioners Guide (Hegmann *et al*, 1999, p. 42), in determining significance, stated that:

" A cumulative effects approach requires determining how much further effects can be sustained by a VEC[2] before suffering changes in condition or state that cannot be reversed."

An approach[3] involving a series of questions are structured to guide the practitioner towards a significance conclusion. The questions revolve around the following:

- increase in effect in combination with effects of other actions

[2] VEC – valued environmental component
[3] developed by Duval and Vonk, 1994 in Hegmann *et al* 1999

- acceptability of effect
- permanence of effect
- recoverability and rate of recovery

Some factors which could influence the interpretation of significance include: exceedance of a threshold; effectiveness of mitigation; size of area; incremental contribution of effects from action under review; relative contribution of effects of other actions; relative rarity of species; significance of local effects; magnitude of change relative to natural background variability; creation of induced actions and degree of existing disturbance (Hegmann *et al*, 1999).

These authors suggested the use of thresholds, carrying capacity and limits of acceptable change. Thresholds are the limits beyond which cumulative change becomes a concern and making conclusions about cumulative effects requires some limit of change to which incremental effects of an action may be compared. Carrying capacity is defined as: *"the maximum level of use or activity that a system can sustain without undesirable consequences" (Ibid, p 47).* They note, however, that application of the concept is a subjective one and depends on the values and context involved. The concept of "limits of acceptable change" shifts the focus from identifying appropriate levels of use to describing environmental conditions that are acceptable.

Significance of effects could also be determined based on context and intensity: *"the significance of an action must be analysed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality"* as suggested by the US Guidelines *Considering Cumulative Effects* (CEQ, 1997, p.44). Thresholds and criteria (levels of acceptable change) can be used to determine significance of effects but this Guide cautioned that these will vary depending on the type of resource being analysed, the condition of the resource and the importance of the resource as an issue. It emphasised that no matter how the criteria are derived, they should be directly related to the relevant cause and effect relationships.

Canter and Canty (1993) developed a sequenced approach for significance determination for cumulative effects. The key issues included the following: whether the cumulative effects exceed limits as contained in laws and regulations, whether a

significant resource is likely to be affected, the sensitivity of the environment to the changes and public concerns.

More recently, Barnes et al (2002) noted that practitioners and decision-makers are faced with the problem of determining significance and argued that there is a need for a strategic framework within which significance determination can be made. They suggested that without a framework that articulates sustainable development and resource management objectives, thresholds and limits of acceptability against which cumulative effects of projects can be considered, practitioners and decision makers will continue to be faced with risks associated with deficient EIAs and legal challenges. They proposed an approach which included a residual effects rating criteria to define the threshold beyond which a residual effect becomes significant.

4.5.4 Need for analytical tools

The tools developed for CEA have been derived from EIA. However, the larger time and space scales and more complex causality in CEA require a more detailed analysis of impact relationships. There is a need for tools to understand causal relationships correctly (Lane et al, 1988). These authors noted that the theory of cause and effects in spatially and temporally extended ecosystems has not been fully developed and suggested that there is a need for intensive theoretical development to expand the analysis into multiple developments and more intricate levels of causality that consider simultaneously the physical and socio-economic aspects of the environment.

4.5.5 Institutional context

Existing institutional context and jurisdictions are not always equipped to deal with cumulative effects problems effectively. There is a mismatch between the boundaries of decisions by environmental managers and the boundaries of the causes and effects of the problem (Irwin and Rhodes, 1991). In many cases, impact assessment is the responsibility of operationally focused government agencies (transport, agriculture, flood control, energy) while the issue of cumulative effects are not just relevant to a particular type of activity but reflects total effects at local, regional or national levels (Erickson, 1994). Addressing cumulative effects requires a broadly empowered agency whose environmental responsibilities extend beyond the narrow operational interests of most agencies. In this context, the implementation of CEA in the UK through the local planning authority may seem the appropriate vehicle for addressing cumulative effects,

since the planning authority is responsible for both environmental policy and development control operations.

A successful resolution of CEA problems requires that they be addressed from an integrated perspective (Lane et al, 1988) and involving multi-agency cooperation (Canter, 1999a). An example of this is the regional cumulative effects management system initiated by stakeholders in Alberta, Canada (Spaling, et al, 2000). Cocklin *et al* (1992a) observed that adopting alternative foci in the analysis and management of cumulative environmental effects would require different institutional arrangements and procedures. However, a fundamental barrier to the initiation of CEA is the uncertainty about the responsibilities for such work (Piper, 2001).

4.6 Summary

This chapter discussed the CEA process, methods and implementation. It provided an overview of CEA practice and issues. The next chapter focuses on the UK planning system, particularly strategic planning, as the context for addressing cumulative effects.

Chapter 5. Planning: the Context for CEA

5.1 Introduction

This chapter explores the relationship between CEA and environmental planning. Then it presents an overview of the UK planning system, focusing on strategic planning. The final section discusses the potential contribution of CEA to environmental planning.

5.2 Environmental planning and decision-making

Planning is a future-oriented activity that seeks to devise strategies, which will lead to desired end states (Rydin, 1998a). Environmental planning refers to the planning of all forms of environmental intervention (Faludi, 1987). Blowers (1993, p.14) defines environmental planning as a comprehensive approach to environmental management which has three basic features:

- takes account of future uncertainty by a precautionary approach
- reflects the integrated nature of environmental processes and policies; and
- takes a strategic view of decision-making.

Rydin and Faludi refer to environmental planning mainly as a planning activity while Blowers takes the concept further by introducing the concept of decision-making, a system of co-ordination and control through participative processes at all levels. Referring to the nature of environmental processes, Blowers (1993, p.15) suggests an integrated environmental planning approach with the following dimensions which relate to the nature of environmental processes:

i) trans-media - since pollution can adopt different forms and environmental pathways, there should be integration of pollution control, waste management and land-use planning;

ii) trans-sectoral – environmental issues cross traditional policy boundaries so that there is a need to take environmental issues in account in policy making;

iii) trans-boundary – the ability to cross political boundaries and must be integrated vertically between different levels of government.

It is worth noting that these dimensions also relate to how cumulative effects are expressed and similarly there is a need for an integrated approach to addressing them.

Blowers (1993) and Selman (2000) envisage sustainable development as the goal for environmental planning and as an analytical concept for developing policies in order to achieve sustainability. The concept of sustainability is a familiar one for British land use planning where natural resource protection and planning has been closely bound together in the past and has come to dominate thinking about environmental policy (Hall, 1993; Selman; 2000). The statutory land use planning system in the UK, which is one part of the wider system of environmental planning is discussed in the following section.

5.3 Planning Theory and Background

Town planning in the UK emerged from a series of radical, reformist ideas about changing and improving the city (Davoudi, 2000) to an old master plan approach which was focused on urban design and towards a *comprehensive integrated approach*, whose essence was the public sector direction of resource allocation, mainly through controlling land use (Rydin, 1998a). Planning practice has been based on the rational comprehensive model (Davoudi, 2000) but there have been developments towards a coherent model of "planning in the general interest in a consensus society" and societal scientific decision-making process (Healey, 1983, p. 7). During the 1990's, growing environmental concerns resulted in a more regulatory and proactive form of planning. Regional planning guidance and development plans were used to deal with allocation of development. Continuing the trend for community participation, a partnerships approach was adopted for development initiatives, such as urban regeneration or local environmental improvements. During this period, planning theory centred on collaborative planning theory (Healey, 1997). This period also saw the return of procedural planning, with the planner viewed as a rational decision-maker, balancing all the costs and benefits of a policy or plan but with the added role of enabling collaboration among stakeholders. The planners' role became mainly that of overseeing the legislative process and mediating with competing interests. In many respects, that role continues today.

In relation to the overall goals for planning, these came from sustainability (Blowers, 1993; Hall et al, 1993; Selman, 2000; Davoudi, 2000). Sustainable development should be regarded as a long term 'meta-objective' and an idealistic benchmark to assess current planning practices (Meadowcroft, 1999, p. 37). In terms of goals and approaches, CEA and planning can be regarded as mutually supportive processes with

the goal of sustainability with both based on rationalist, comprehensive and collaborative approaches.

5.4 UK Planning System

5.4.1 Introduction

The town and country planning system is designed to regulate the development and use of the land in the public interest. Land use planning in the UK today has remained largely unchanged since the introduction of a comprehensive planning system under the 1947 Town and Country Planning Act. This section outlines the procedures and policies of the planning system, appraisal approaches and strategic tools used in planning for assessing environmental impacts.

5.4.2 Government Guidance

The planning system in the UK is characterised by a tiered system of planning control. At the top tier are the statutory provisions and the guidance given by policy statements from the national government. National government guidance on planning matters is issued through circulars and planning policy guidance notes (PPGs) on specific topics. Circulars and guidance notes are important sources of government policy and interpretation of the law. For example, PPG 1 sets out the general principles under which the planning system is to operate. PPG 11 *Regional Planning* (DETR, 2000a) advises on the preparation of RPGs and PPG 12 *Development Plans* (DETR, 1999) provides a comprehensive statement of Government policy in relation to the development plan process. PPGs should be taken into account in preparing development plans and in decisions on individual planning applications.

The next level of guidance is provided by regional planning guidance (RPG). The RPG sets out broad framework and strategic policies for development at a regional level. Its main purpose is to provide a regional spatial strategy within which local authority development plans and local transport plans can be prepared. It identifies the scale and distribution of provision for new housing and priorities for the environment, transport, infrastructure, economic development, agriculture, minerals and waste treatment and disposal in the region. Furthermore, it sets out policies that need to be considered on a scale wider than the area of a single authority. National and regional planning guidance provide the policy framework for the preparation of development plans.

5.4.3 Development Planning

The land use planning system in the UK has two key elements: development planning and development control. Under development planning, plans are prepared by local authorities to guide development and environmental change in their area. These plans are at two levels: strategic and detailed local level. Legislation (Section 54A of the Town and Country Planning Act 1990) requires that decisions made should be in accordance with the development plan unless material considerations indicate otherwise.

In areas where there is a two-tier structure of county and district councils, strategic planning is provided by structure plans prepared by county councils. Within metropolitan areas and in some non-metropolitan unitary authorities, the development plan comprises a single Unitary Development Plan (UDP) which consist of two parts: Part I consists of a written statement of the local authorities' strategic policies for the area (along similar lines to a structure plan) and Part II sets out detailed proposals.

Structural plans and UDP Part I set out general policies regarding the development and use of land and include specific policies relating to the conservation and amenity and proposals for improving the physical environment and traffic management schemes (DOE, 1992).

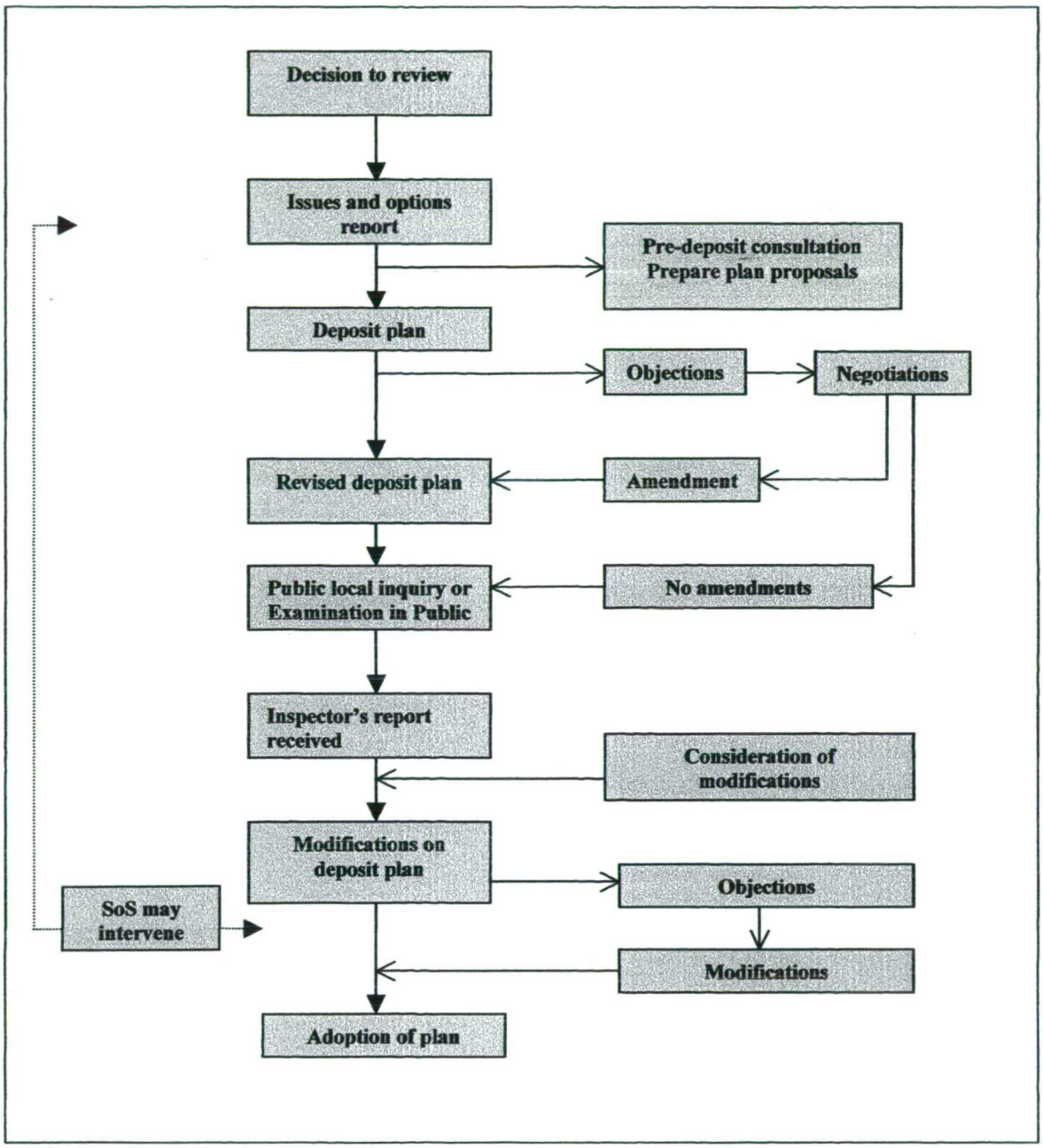
Local plans and UDP Part II set out detailed land use policies for the local authority area. They may include detailed proposals for specific sites. Both plans include a map showing what types of developments are considered appropriate and where. A reasoned justification of general policies must be given in the Local Plans and must be in general conformity with strategic policies in the Structure Plan. Table 5.1 shows the types of development plans.

Table 5.1 Types of Statutory Development Plans

Development Plan	Produced by	Purpose and form
Structure Plans	- county councils - some unitary authorities - National Park authorities	- Set out key, strategic policies - Provide framework for local plans - Written statement of policies and proposals for development and use of the land in the area, illustrated in a key diagram
Local Plans	- district councils - some unitary authorities - some National Park authorities	- Set out detailed policies to guide development in a particular local authority area - Make proposals for the development and use of land and allocate land for specific purposes - Show policies and proposals in a base map. - Designate areas for certain types of development in a land use map
Unitary Development Plan (UDP)	- London boroughs - metropolitan authorities - some non-metropolitan unitary authorities	- Contains all the planning policies relevant to those areas - Part I and Part II cover structure plan and local plan functions respectively
Minerals Local Plan	- county councils - some unitary authorities - some National Park authorities	- Indicate areas where provision is made for mineral working and areas to be safeguarded for future working - Set out development control criteria - Should conform with structural plan
Waste Local Plan	- county councils - some unitary authorities - some National Park authorities	- Sets out detailed land use policies for the management and disposal of waste, within the broad strategic framework of the strategic plan - Should address need for sites and facilities in particular areas, suitable locations and planning criteria - Can be prepared separately or combined with the minerals local plan for the area

Statutory requirements for preparing Local Plans and UDPs are contained in the Town and Country Planning (Development Plan) (England) Regulations 1999 and supported by PPG 12. More recently, the Office of the Deputy Prime Minister (ODPM) issued *Making Plans: A Practical Guide* (ODPM, 2002b) to assist planners in the plan-making process. It takes into account the principles underlying the proposed changes in the *Planning Green Paper, Planning – delivering a fundamental change* (ODPM, 2001) and preparation of Local Development Frameworks. The development plan process is shown in Figure 5.1 based on the above guidance.

Figure 5.1 The development plan process



SoS (Secretary of State)

Sources: Adapted from PPG12, Chapter 2; ODPM, 2002b).

Local planning authorities (LPAs) use supplementary Planning Guidance (SPG) as a means of setting out more detailed guidance on the way in which the policies in the plan will be applied in particular areas. SPG does not form part of the plan but takes the form of design guides and area development briefs. It must be consistent with national and regional planning guidance and policies set out in the adopted development plan.

LPAs also produce relevant policy documents such as transport policies and programmes and local transport plans. Other outputs include informal plans and

indicative strategies, including site-based management plans and design/development briefs.

5.4.4 Regional Planning

In 1991, the Planning and Compensation Act 1991 established an upper tier of planning through the regional planning guidance (RPG) system by requiring that while developing structure plan policies, local authorities were to have regard to RPG. The purpose of the RPG was to provide a broad development framework for the next twenty years or more and sets the context for the preparation of local authority development plans. RPG provides advice to local authorities on central government's view regarding the distribution of development across the country and on how to deal with any special features in the region that are of particular importance. In 1998, the primary responsibility for preparing RPG was transferred from the Government Office for the Region to the Regional Planning Body under the provisions of the *Regional Development Agencies Act*. This Act established regional development agencies in each of the nine English Regions.

In December 1999, PPG 12 (DETR, 1999) was revised to provide a more strategic overview of the role and importance of development plans within the planning system. Matters relating to regional policy were moved to a new PPG, PPG 11 *Regional Planning*, which was published in October 2000. PPG 12 *Development Plans* (DETR, 1999) provides a comprehensive statement of government policy in relation to the development plan process and offers advice on the reformed procedures for the adoption of unitary and local plans following the Town and Country (Development Plan) (England) Regulations 1999 (SI 1999 No.3280). PPG 12 also develops the theme of sustainable development in relation to the development plan process and the relationship with transport plans. Ball and Bell (1991) contended that the most notable policy guidance in the mid 1990s has seen the use of planning to contribute to the goal of sustainable development.

5.4.5 Environmental Impact Assessment Legislation

A significant piece of legislation introduced in 1988 was the Town and Country Planning (Assessment of Environmental Effects) Regulations 1988 (SI No. 1199) requiring environmental assessments as a standard element of planning procedure.

In 1997, the EU issued the amended EIA directive (97/11/EC), which extended the categories of projects subject to assessment as well as strengthening the process. Under the amended directive, local authorities will have to give advice to developers on the scope of information to be included in the environmental statement. This directive was implemented in the UK under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 1999 No 293).

In 2001, the EU adopted the Strategic Environmental Assessment Directive (2001/42/EC), which extended this process of environmental assessment beyond specific projects to plans, programmes and policies. This Directive is to be transported into UK law by 21 July, 2004. The proposed EU Directive on SEA will require appraisals of development plans as well as programmes in sectors such as transport, energy, waste management and water resource management. The procedures mirror those for project based environmental assessment.

In the UK as well as the rest of Europe, the spread of new concepts and ideas in planning has been accelerated by the role of the European Union. Procedures and institutions had to change as a result of the European Community requirements. This trend has implications for planning in the UK particularly in terms of planning procedures and environmental regulation.

5.4.6 The future of planning

In August, 2001 the government announced its plans to reform the planning system. Stephen Byers, the then Secretary of State for the Department of Transport, Local Government and the Regions, announced that ten years after the local plan system was set up in 1991, 16% of the 362 local planning authorities had not put a plan in place (Grant, August, 2001). In Dec 2001, the ODPM issued *Delivering a Fundamental Change: the Planning Green Paper*, which included a proposal to do away with structure plans, to convert RPGs into Regional Spatial Strategies and to introduce Local Development Frameworks, in place of current local development plans. The Green Paper proposals were generally confirmed by a policy statement, *Sustainable Communities – Delivering through Planning* (ODPM, July 18, 2002). Further details were provided in *Making the System Work Better- Planning at Regional and Local Levels* (ODPM, July 18, 2002).

In December 2002, measures contained in the Planning and Compulsory Purchase Bill (2002), which draws primarily upon the Planning Green Paper, was introduced to the House of Commons[1]. The Bill proposes major changes such as the transfer of responsibility for strategic planning to regional bodies from county councils and a move away from the land use plan to a strategic, policy focused document. Some of its major proposals include:

- at regional level, regional spatial strategies (RSS) supersedes RPGs;
- at the district and county councils, abolishes structure plans, UDPs and local plans to be replaced by local development documents;
- transfers strategic planning responsibility away from the county councils to the regions;
- the range of matters to be kept under review has been broadened to include social and environmental characteristics, thereby capturing the three principal components of a sustainable development strategy[2].
- making sustainability appraisal mandatory.

As seen, sustainability appraisal will be mandatory under the proposed changes, which would have wider implications on the implementation of the SEA Directive and on CEA. This issue will be discussed further in Chapter 13.

Other changes relevant to the environmental assessment of plans include making RSS more specific than RPGs and have more fully developed sub-regional elements as part of the overall regional strategy. It envisages that some areas may need a separate sub-regional strategy, such as for Thames Gateway,[3] which cuts across three regions, but in general sub-regional issues would be dealt with in sub-regional sections of the RSS.

The Bill reflects a *rational-comprehensive approach* to planning which starts with a survey of existing conditions and analysis, upon which to base policies to achieve objectives. LPAs are required to prepare local development documents (LDDs). There are two types of LDDs: development plan documents (DPDs) and other non-statutory plans and supplementary planning documents. DPDs are documents that have been

[1] Since writing this thesis the Bill has been enacted by Royal Assent on the 13th May 2004 but it is not yet enforced.
[2] The 1990 Act only required review of the principal physical and economic characteristics of the area.
[3] At present, RPG 9a (1995) sets the framework for the development of Thames Gateway and its proposals have been incorporated into relevant RPGs.

through formal scrutiny and approvals process and carry much weight in decision-making. LDDs are likely to be more strategic than existing plans, with criteria-based policies rather than land-use allocations. These changes are likely to have a bearing on plan assessments.

As to what these regulations might require, the Minister suggested the following (Standing Committee G, *Official Report*, col 213; 16 January 2003, in Grant, 2003):

- a core strategy which will contain the core policies for delivering the spatial strategy for the whole of the local authority area and supported by a reasoned justification;
- site specific policies and proposals including a proposals map for the whole of the local authority area. The proposals map will show existing and revised designations of areas of land, define sites for future development and areas to which specific policies apply. The location of any proposed action area plans should also be shown.

In preparing an LDD, the local planning authority is required to have regard to: national policies and advice contained in government guidance; the RSS for the region where the local authority is situated and RSSs in neighbouring regions; the community strategy prepared by the LPA and community strategies of neighbouring authorities. The LPA must also prepare a statement of community involvement and carry out an *appraisal of the sustainability of the proposals in each document and prepare a report of the findings of the appraisal.*

In addition, LPAs are required to prepare an annual monitoring report, which provides information on:

- the implementation of the local development scheme;
- the extent to which the policies set out in the local development documents have been achieved.

5.3.7 Role of the planning system in environmental planning

It is established government policy that the planning system should have a principal role in implementing sustainable development (HM Government, 1994, DOE, 1992, DETR, 1999 and DETR, 2000a). Others also regard land use planning as having an important role in moving towards sustainable development (Blowers, 1993; Owens and Colwell,

2001). Through the planning function, environmental policies are formulated so that environmental impacts can be mitigated and resources conserved.

Although town and country planning has focused more narrowly upon land and so could only exert indirect and tenuous influence over some aspects of the environment, it has tackled complex problems associated with multiple interest groups and systems (Selman, 1999). The recognition that human and scientific issues are interconnected has led to changes in approaches from a single discipline to one that is integrated involving a range of agencies and parties. Also, the "understanding of the 'environment' has broadened from a predominantly reductionist account of bio-physical phenomena..... to 'quality of life' issues" (Ibid, 1999 p. 154).

To address these wider environmental concerns, Hall et al (1993) argued that planning requires a widening of scope. Environmental planning should be an integrated process, which ensures that sustainability is built in as a primary objective at all levels across the range of policies that affect the environment. Environmental planning involves land use and transportation, the control and management of pollution and the conservation of resources and so environmental considerations should be woven through decision making in all sectors.

In terms of decision-making, Selman (1999) argued that environmental planning should be viewed as a rational human activity, which optimises welfare in the present and future. But he also notes that pragmatic planning, which incorporates ideas from politics and economics may lead to better results and that realist models may represent more accurately the non-linear and interactive nature of actual planning decisions. It may well be that the essential purpose of environmental planning is to help us cross the 'sustainability transition' (Selman, 1999 p.156).

In the context of environmental planning, the role of land use plans is to set out detailed implementation of policies for sustainable development and is the point where national and regional policies are articulated. Most plans are prepared for local authority areas but recently, the scope of planning has been widened as more plans have been prepared for regions. It is at this level that land-use and environmental implications of sectoral policies may be identified (Blowers, 1993).

5. 5 Appraisal of plans

5.5.1 Environmental considerations in planning

The 1991 Planning and Compensation Act required that development plans should include policies for conservation, amenity and improvement of the physical environment. The Town and Country (Development Plan) Regulations 1991 required local planning authorities to take environmental considerations into account when preparing development plans. The guidance for preparing plans, *Making Plans: a practical guide* (ODPM, 2002a) recommends that social, economic and environmental considerations should be included. Some environmental considerations for development plans covered by relevant guidance are listed in Box 5.1.

Box 5.1. Environmental considerations for development plans

- energy conservation and efficient use of energy (PPG 22);
- reducing the need to travel (PPG 13);
- air quality and pollution (PPG 23);
- noise and light pollution (PPG 23);
- the need to sustain the character and diversity of the countryside (PPG 7) and undeveloped coasts (PPG 20);
- conservation and enhancement of wildlife habitats and species, including the promotion of diversity (PPG 9);
- the impact of development on landscape quality (PPG 7);
- policies and proposals for the improvement of the physical and natural environment in urban areas;
- policies which help preserve the built and archaeological heritage (PPG 15 and 16);
- the need to protect ground water resources;

Source: PPG 12, Chapter 4 (DOE, 1992).

In order that the environmental considerations are taken into account in preparing plans, the Government has advocated the use of environmental and sustainability appraisals (PPG 12 and PPG11). Therivel (1998) identified environmental appraisals of development plans as a form of SEA carried out in the UK. These appraisals are characterised by their qualitative approach, brevity and low cost. However, there are basic differences between environmental/sustainability appraisals and SEA in terms of philosophy and process. In the former, impacts are appraised against objectives while in the latter; impacts are assessed against the baseline. This issue is discussed further in Chapters 7 and 9.

5.5.2 Environmental Appraisal

In the UK, the Government has been advocating the environmental appraisal of development plans for several years and PPG 12 requires local planning authorities to conduct an environmental appraisal of plans, policies and proposals as they are being drawn up. *Environmental Appraisal of Development Plans: A good practice guide* (DOE, 1993) sets out a framework which local authorities can adapt to their particular circumstances. This guidance was further refined in *A Step by Step Guide to Environmental Appraisal* (Bedfordshire County Council/Royal Society for the Protection of Birds (RSPB), 1996).

The DOE guide suggested key tasks involved in environmental appraisal: i) characterise the environment ii) scope the plan and iii) appraise the plan policies and proposals to determine whether the plan's objectives and policies are internally consistent and assess the likely environmental effects of policies and proposal options.

A survey of 69 environmental appraisals published between 1993 and 1997 found a number of deficiencies in the appraisal method, one of which is the failure of the DOE Guide to consider cumulative effects (Russell, 1999). Thus, only three authorities in the sample had considered cumulative effects. Bedfordshire County Council/RSPB (1996) noted the lack of attention to cumulative effects in appraisals and the failure to account for the overall environmental effects early in the process. Environmental appraisal does not effectively address cumulative effects for two reasons: i) the focus of environmental appraisal is consistency and compatibility of policies which are appraised against strategy objectives while CEA assesses impacts of policies on baseline conditions relating to valued resources. ii) CEA requires that baseline conditions and trends relating to the valued resources should be established. The baselines used in appraisals do not have the required level of detail.

Other researchers have also noted some failings of the environmental appraisal procedure, such as lack of consultation and integration into the plan-making process (Curran et al, 1998; Zagorianakos, 1999; Glasson and Gosling, 2001).

5.5.3 Sustainability appraisal

National initiatives relating to the sustainable development agenda have required a broadening of the issues covered in environmental appraisals. The Government's

approach to sustainable development was set out in *A better quality of life, a strategy for sustainable development in the UK* (DETR, 1999). This strategy indicated a range of objectives, key actions and indicators to help measure progress towards sustainable development. It recognised that the planning system and development plans in particular, can make a contribution to the achievement of the Government's objectives for sustainable development.

The DETR's advice on how to extend the methodologies used for environmental appraisal to cover economic and social issues was issued in *Planning for Sustainable Development: Towards a Better Practice* (DETR, 1998). The Department published guidance for undertaking sustainability appraisals as *Good Practice Guide on Sustainability Appraisal of Regional Planning Guidance* (DETR, 2000b).

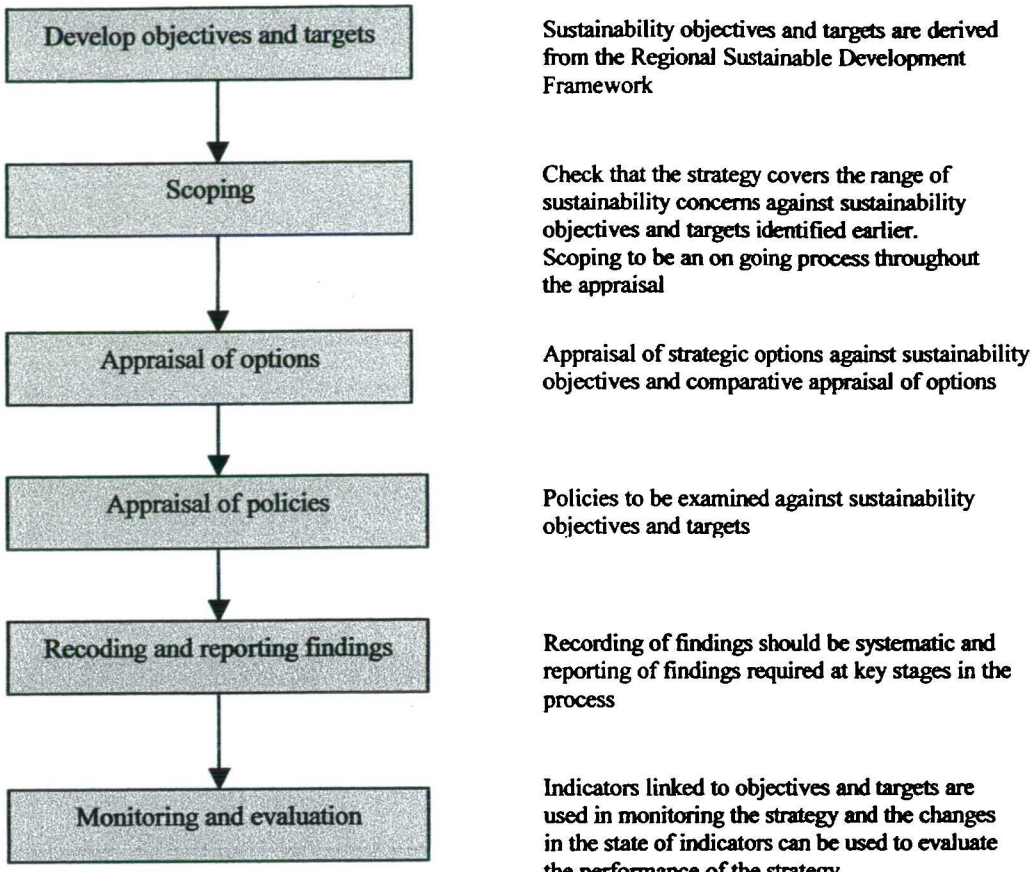
Sustainability appraisal is defined as:
" *a systematic and iterative process undertaken during the preparation of a plan or strategy, which identifies and reports on the extent to which the implementation of the plan or strategy would achieve the environmental, economic and social objectives by which sustainable development can be defined, in order that the performance of the strategy and policies is improved"* (DETR, 2000b, p. 9).

Sustainability appraisal is seen as a means to ensure that by appraising the potential impacts of strategic options, consideration of sustainable development is integral to the strategy making process. It is expected to appraise:

- the scope of the strategy to identify how it accords with sustainable development objectives;
- the alternative strategic spatial options for development and change which is to take place in the region and the chosen spatial strategy;
- the strategic policies and proposals.

The DETR Guide suggests that although the process should be undertaken during strategy making, an independent team from those preparing the strategy should undertake the appraisal to provide the necessary objectivity. Figure 5.2 sets out the sustainability appraisal process.

Figure 5.2 Sustainability appraisal process outlined in the DETR Guide



Source: adapted from DETR, 2000

PPG 11 *Regional Planning* (DETR, 2000a) provides advice on the preparation, scope and content of the Regional Planning Guidance. It suggests that the sustainability appraisal should evaluate the *cumulative effects* in relation to options, including an assessment of distributional effects, both geographic and socio-economic. The DETR Guide to Sustainability Appraisal (2000b) suggests that the appraisal of the initial, direct impacts should be followed by an appraisal of the consequential, secondary and cumulative impacts. It suggests two types of *cumulative effects* relating to RPGs:

- the combined impacts of all policies and proposals on specific areas;
- repeated impacts on specific objectives and targets.

It recommends that the appraisal of *cumulative impacts* should follow the procedure used for options and policies and that those potential impacts need to be assessed against sustainability objectives. Furthermore, if several policies affect the achievement of an objective, their *cumulative effect* needs to be assessed, since in combination, they may cross a threshold.

Counsell and Bruff (2001) observed that the DETR Guide built on the strengths of Environmental Appraisal by adopting a broad approach to policy appraisal which takes account of the four objectives of sustainable development. It therefore addresses concerns regarding the narrow focus on environmental criteria in environmental appraisals. But it needs to place more emphasis on stakeholder consultation at the formative stages of the process and seek to increase the overall transparency of the process (Ibid, 2001).

Although the DETR Guide on sustainability appraisal was prepared for Regional Planning Guidance, the method has also been used in appraising development plans. Some of the appraisals reviewed as part of this research were sustainability appraisals and the findings revealed that cumulative effects were not sufficiently addressed (see Chapter 6). It should be noted that Sustainability Appraisal follows a similar procedure as environmental appraisal and policies are appraised against objectives and so for the same reasons as environmental appraisals, the procedure does not allow cumulative effects to be addressed. This issue is further discussed in Chapter 13. Apart from appraisals, planning uses other strategic tools to address potential impacts. These are discussed in the following section.

5.5.4 Strategic tools for planning

It is widely accepted that the planning system has a role in achieving sustainable development. In order to fulfil that role, planning requires strategic tools that can deal with the issues that breach the principles of sustainable development. Selman (2000, p.18) noted that one of the changes in planning has been the shift from trying to mediate between competing land uses towards 'respecting capacities' in terms of the environment's intrinsic limits. Strategic tools for sustainability planning include environmental and carrying capacities studies, limits of acceptable change, environmental/quality of life capital.

Some of these tools, such as carrying capacity, limits of acceptable change (LAC) and threshold analysis have been proposed as useful methods for evaluation of cumulative effects (see Section 4.4). Environmental capital has been developed to evaluate environmental benefits from resources but has not been used in CEA (CAG/LUC, 1997). It has been extended to cover social and economic considerations and been renamed as "quality of life" capital.

There are two contexts for carrying capacity in relation to CEA: ecological and social (CEQ, 1997). Ecological carrying capacity is the threshold of stress beyond which populations and ecosystem functions cannot be sustained. Social carrying capacity for a region is the sum of human activities that can be maintained while providing the level of services desired by the population. Apart from evaluating cumulative effects, the method can also be used to monitor incremental use of capacity.

Environmental capacity has been used in planning (e.g.West Sussex, Chester) and appraisal to provide clarity in assessing environmental change (DETR, 1997). LAC has been applied to tourism management and CEA (Wight, 1994). Threshold analysis is necessary for CEA and three ways for identifying thresholds are:

1. use of external standards
2. comparison with other areas over time
3. use of professional judgement and perception studies.

(Aurp, BDP et al, 1995 in DETR, 1997)

Thus, tools already used in planning can also be applied in CEA and Table 5.3 lists some of these tools and evaluates their application to CEA.

Table 5.3 Evaluation of planning tools for CEA

Criteria	Carrying Capacity	Environmental Capacity	Limits of Acceptable Change	Threshold Analysis	Environmental/Quality of Life Capital
Possible application to CEA	Necessary for understanding environmental issues; can be used to evaluate cumulative effects by identifying thresholds for resources	Can be used to analyse the amount of development that a locality can accommodate without severe environmental impacts	Can be used to evaluate significance of cumulative effects in terms of value judgements involving a wide range of interest groups	Identifies physical thresholds beyond which development should not take place without mitigation or setting new thresholds	Can be used to identify important environmental features or resources; what kind of protection or management required to retain or enhance environmental features
Scope	Physical, ecological and social capacities relating to valued resource	Can cover a wide range of issues	Has been applied mainly to tourism and visitor issues	Can apply to a wide range of issues	Can apply to a range of resources
Practicability	Problems in measurement and practical difficulties relate to imperfect understanding of carrying capacity thresholds and consequences of exceeding them	High resource requirements; May need specialist inputs	May need specialist inputs	May need specialist inputs	Relies on value judgements
Data requirements	Regional data or surveys may be required	Survey data may be required	Survey data on defining acceptability	Baseline and trends; May require survey data	Data on attributes, benefits and services of resource
Rigour	Rigorous	Rigorous	Rigorous	Rigorous	Rigorous
Strengths	Provides true measure of cumulative effects and addresses time factors	Can establish quality of environmental resources	Takes a collaborative approach to problem solving and conflict resolution	Provides a measure of the status and trends relating to the resource	Help identify likely effects of alternative options on environmental resource and support other tools- SEA, environmental capacity and appraisal
Limitations	May involve multiple thresholds to consider which complicates analysis; May need specialist skills	Not all data may readily be available	Focuses on change to the environment that the public are willing to tolerate and not on quality of resource	May need specialist inputs	May need specialist inputs; untested in terms of CEA

5.6 CEA in Planning

The need to consider cumulative impacts in development plans is stated in government guidance (DETR, 1997; DETR 2000a; DETR, 2000b; ODPM, 2002a). An appropriate framework for addressing cumulative impacts may not be through the techniques and approaches of environmental assessment but by considering cumulative impacts as planning issues (Bardeki, 1990). Bardecki used the example of integrated planning of agricultural land drainage networks and argued that specific goals established in the appropriate planning level (regional, local) with definable thresholds could address cumulative impacts.

Other researchers also hold the view that cumulative impacts can be addressed more effectively at strategic levels. Clark (1994) maintained that CEA is best undertaken at the programme or policy level because alternatives have not already been decided by then. Others have noted the advantages of incorporating CEA into a planning approach which allows the comprehensive examination of all relevant impacts at an appropriate scale and information from the CEA can assist in the routine assessments of smaller projects or be used for reviewing contributions of projects (Cooper and Zedler, 1980; Dickert and Tuttle, 1985; Sigal and Webb,1989; Abbruzzee and Leibovitz,1997).

Many authors have suggested that CEA should be implemented in a regional planning framework (Dickert and Tuttle, 1985; Sonntag et al, 1987; Peterson et al, 1987; Hubbard, 1990; Colnett, 1991; Damman et al, 1995; Creasey, 2000). Roots (1986) suggested that CEA could inform the regional planning process on what could be done about cumulative environmental change. Focusing on an urban area, Colnett (1991) concluded that regional planning is a suitable context for the management of cumulative effects in the Vancouver region. CEA frameworks in planning have been developed (Kalf, 1995; Kingsley, 1995; Damman *et al*, 1995) and are discussed in Section 3.6.

The CEAA's Practitioners Guide to CEA (Hegmann *et al*, 1999) proposed that cumulative effects approaches should be used as an integral part of regional planning or land use study. On the theme of regional planning and sustainable development, Rees (1988 p.285) suggested that to achieve "sustainable levels of economic activity within carrying capacity, society will have to adopt more rigorous and deterministic approaches to regional planning". Thus, land use and development patterns would have to be controlled under sustainable planning criteria. Within this framework, "CEA

would provide the means to estimate how close the development limits specified and imposed by the carrying capacity considerations of the regional plan" are (Ibid, p.286). Rees thereby defined CEA's role in planning.

5.6 Summary

This chapter has explored the relationship between planning and CEA. It has found that both are based on rational, comprehensive and integrated approaches and use complementary tools. Planning as a context for CEA can take two forms: CEA as part of land use planning or as part of a plan assessment. The next chapter examines CEA practice in the UK at project and strategic levels.

Chapter 6 Establishing Current CEA Practice

6.1 Introduction

This chapter describes the results of a review of Environmental Impact Statements and Environmental/Sustainability Appraisals to investigate the subsidiary research question:

To what extent and how are cumulative effects currently considered in environmental assessments of projects and plans?

This stage of the research was undertaken to establish consideration of cumulative effects in environmental assessments at project and strategic levels in order to gain a better understanding of the research problem. Initially, the consideration of these effects in project EIAs was investigated. The assessment of cumulative effects in UK EISs has been perceived as poor (Glasson et al, 1995; Pritchard, 1993; Fuller and Sadler, 1999). Previous reviews of EISs concerned with overall quality (Jones et al, 1991; Therivel et al, 1992) and those concerned with ecological assessments (Treweek et al, 1993; RSPB, 1995; Byron et al, 2000) have noted that cumulative effects were not considered. At the strategic level, there have been some reviews of environmental appraisals (Therivel, 1998; Curran et al, 1998; Russell, 1999) but these reviews considered overall quality and did not focus mainly on the consideration of cumulative effects. There have been reviews of EIAs that have focused on cumulative effects considerations in the US (Mc Cold and Holman, 1995; Burris and Canter, 1997) and in Canada (Baxter et al, 1999; Angeles Mendoza et al, 2000), but none on the UK. So far, there is no documentary evidence of the extent of the consideration of cumulative effects at both the project level and plan levels in the UK.

The literature suggested problems relating to EIAs in assessing cumulative effects: lack of accepted definition of the concept, appropriate guidance and assessment framework and limitations in scope (see Section 4.5). Thus, the EIS review examined the following: current understanding of cumulative effects, approaches, processes and any guidance used in the assessment. The review sought to identify any problems, constraints and best practice examples that could inform the rest of the research. The research findings from the review of EISs were subsequently published as:

Cooper, LM and Sheate, WR (2002). Cumulative effects assessment: A review of UK environmental impact statements. *Environmental Impact Assessment Review* 22: 415-439.

The second element of this stage of the research involved a review environmental and sustainability appraisals to establish whether cumulative effects were being considered at strategic levels and to what extent. Some authors have observed that cumulative effects are not often addressed in plan appraisals (Bedfordshire County Council and RSPB, 1996; Russell, 1999). The aim of this review was to find out the degree these effects are taken into account in the case study area, the Thames Gateway. The findings would therefore help define the research problem, the context for the research and provide a baseline of current CEA practice.

6.2. Review of Environmental Impact Statements

6.2.1 Method

A sample of 50 EISs in the EIS collections held by the Department of Environment, Transport and the Regions (DETR[1]), Department of Environmental Science and Technology at Imperial College as well as those provided by personal contacts were reviewed from March to July 2000. The sample consisted of various types of projects and geographical locations. Figure 6.1 illustrates the composition of EISs reviewed, grouped into broad categories of development. Figure 6.2 shows a breakdown of the EISs by regional location and a list of the EISs reviewed is shown in Appendix 1.

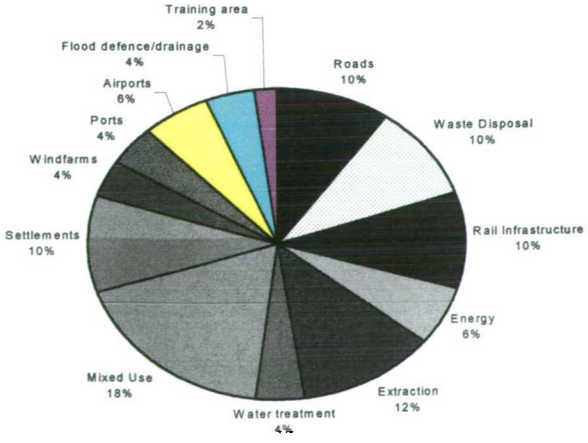


Figure 6.1: EIS Sample Project Types

[1] Since May 2002 the Office of the Deputy Prime Minister (ODPM)

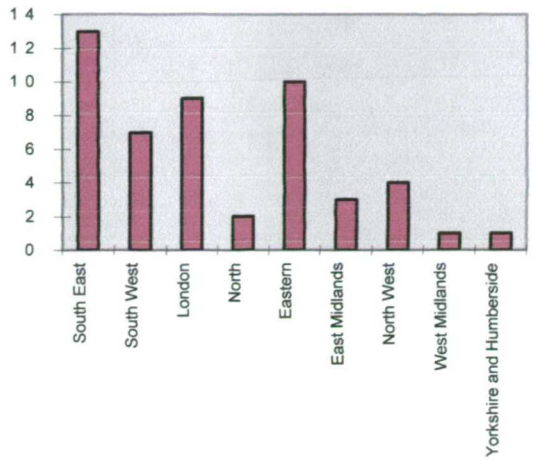


Figure 6.2. EIS Sample by Region

Although the EISs were randomly chosen from the sources mentioned above, a stratified sampling procedure was followed. Within the sample, three sub samples were included: urban regeneration projects (8 EISs), a number of projects in a sub region, the Thames Gateway area (13 EISs) and eight pairs of projects located adjacent to each other or within a defined area. Urban regeneration projects were seen as potentially having significant effects (e.g. traffic and air pollution) requiring serious consideration of cumulative effects particularly because these projects are often being promoted as part of planned programmes of associated developments within a regeneration framework. Among the remainder, as balanced a sample as possible across other sectors was selected. The EISs were prepared from 1989 to 2000. Majority of the sample (56%) were EISs prepared between 1999 and 2000 to give an indication of current practice [24 (48%) EISs prepared in 2000 and 4 (8%) EISs prepared in 1999]. Earlier EISs included 11 (22%) EISs between 1989-1994 and 11 (22%) EISs between1995-1998.

The sample of EISs reviewed was limited to the EISs that were available in the libraries mentioned above. Any conclusions from the study are therefore indicative and not definitive. Apart from the main EIS report, other relevant documents were examined, which included the non-technical summary, supplementary reports, planning statements and scoping reports. The reason for examining documents other than just the EIS was to get a better picture of the EIA process as a whole, rather than just what was reported in the EIS. The aim of the review, therefore, was to investigate the extent cumulative effects are considered in EIAs, rather than simply the quality of the EISs themselves.

Detailed review criteria were developed, based on CEA evaluation frameworks (US CEQ steps in CEA (1997) and Burris and Canter's criteria questions (1997) and UK guidance on environmental assessments (DOE, 1989; DOE, 1995; DETR, 2000). The review process focused on the concepts of cumulative effects; the approach to CEA; methods used to identify and predict cumulative effects and proposals for mitigation and monitoring measures. The review examined the different stages of the EIA process and their documentation. Furthermore, since the literature suggested that cumulative effects are generally not considered adequately in UK EIAs because of lack of appropriate guidance, the review investigated if any guidance was referred to, in particular, if the EC guidance published in 1999 had been used in recent EIAs. The review criteria schedule is included in Appendix 2.

6.2.2 Results from the Review of EISs

6.2.2.1 Concepts of cumulative effects and documentation

The results from the review are summarised in Table 6.2. Only 24 (48%) EISs mentioned the term 'cumulative impacts/effects'. A further 4 (8%) EISs referred indirectly to cumulative effects through the use of the following phrases: in-combination effects, combined effects or effects interactions.

Table 6.1. Results of review of 50 Environmental Impact Statements

Review criteria	No of EISs
Mentioned 'cumulative effects'	24
Provided a definition of cumulative effects	8
Referred indirectly to cumulative effects by using the following terms: combined effects; in-combination effects or interaction of effects	4
Identified potential cumulative effects - Concluded that there were no cumulative effects without any assessment - Concluded that cumulative effects were insignificant without any assessment	15 1 4
Provided some analysis of cumulative effects: - Discussed cumulative effects for all affected resources: - identified other developments - identified only similar developments or actions - identified one other action - Discussed cumulative effects for some affected resources: - identified other developments - identified only similar developments	9 5 1 2 2 4 3 1

The term 'cumulative effects' was mentioned in the non-technical summary, table of contents or introduction in 18 (36%) EISs while 5 (10%) EISs mentioned the term in the EIS, one EIS referred to cumulative effects in a letter to the competent authority and one EIS mentioned the term in the planning statement. Of the EISs that mentioned 'cumulative effects' 11 (22%) EISs were prepared in the year 2000 (out of 24 prepared in the same year), which seem to suggest an increasing awareness of these effects in more recent EISs.

Eight (16%) EISs provided a definition of cumulative effects. Some of the definitions of cumulative effects were:

- *'the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions'* as defined in the National Environmental Policy Act (1969) (Isle of Grain EIS and Woodville EIS);
- *'an analysis of the consequences of more than one direct &/or indirect impact acting together'* (Barrow, 1997) in (Westhay Heath EIS);
- *'if there is more than one factor from a site impacting upon the local population &/or the local environment this would be a cumulative impact, for example, noise & dust'* (Kingsnorth Landfill Site EIS);
- *'cumulative impacts relate to the sum total of the effects of either individual operations or entire schemes on a single person, the community or the local environment over a period of time'* (Woodhead EIS);
- *'Cumulative effects arise from accumulation of a number of effects, either:*
  - *of a different nature at a particular location...;*
  - *at different locations but affecting the same resource...;*
  - *of the same nature at different locations...; or*
  - *over a period of time'* (Channel Tunnel Rail Link (CTRL) EIS).

The most comprehensive definition was provided by the CTRL EIS. One EIS (Rochdale) commented on the lack of guidance on assessing cumulative effects, but consulted the Institute of Environmental Assessment and interpreted cumulative effects in terms of:

- *'effects of development over time (i.e. "residual" effects);*
- *effects of development in terms of space elsewhere (i.e. "off-site" effects);*
- *effects of development in relation to other effects (i.e. "synergistic" effects).'*

One EISs (Otterburn) observed that there is no accepted definition of cumulative effects but considered three types of cumulative effects in scoping:

- *'the 'additive' effect of proposals that individually are of minor/moderate significance, but in total have an effect of major significance;*
- *incremental effects, the effect of what is proposed, taking into account existing activities and developments and their interactions with the environment;*
- *where the level of effect reflects the timing of impacts over a certain period.'*

Other concepts of cumulative effects were: changes in environmental quality; the sum of direct and indirect impacts; residual impacts after mitigation and combined effects of individual impacts from developments on receptors. As can be seen from the above definitions, there are various interpretations of the concept of cumulative effects. The situation is further complicated by the requirement under the Habitats Directive, which introduces the concept of in-combination effects.

The review revealed the following concepts of cumulative effects:

1. **Cumulative effects as residual effects** (Thameside Gas Pipeline and Beldevere Combined Heat and Power Plant EISs);
2. **Cumulative effects as a combined effect by two projects** (the CTRL & M2 EISs, Testwood Lakes EIS and the Heathrow Express (considering Heathrow Terminal 5 ES));
3. **Interactions of impacts of the project** (Stonecastle Farm quarry EIS and Westhay Heath EIS);
4. **Impacts from the proposed project and from other past, present and future projects/actions** (Ebbsfleet Devt, Trinity III Terminal Extension and the Ipswich New Quays EISs);
5. **Impacts of developments within a scheme** (Swale Gateway EIS and Otterburn EIS).

The type of cumulative effect concept adopted in an EIA subsequently influenced the range of impacts investigated in the process. For example, where cumulative effects were considered as residual impacts, the discussions were limited to the identification of the direct and indirect impacts that might remain after mitigation. A narrower interpretation of the concept (such as concepts 2, 3 and 5) resulted in a limited range of

impacts investigated. On the other hand, a broader interpretation, such as concept 4, led to the consideration of impacts of a number of projects in the wider area.

The reporting and documentation of cumulative effects were generally poor, except for a few cases. Most of the EISs that mentioned cumulative effects in the introduction did not address cumulative effects further in the EIS. One EIS concluded that there were no cumulative impacts without any analysis. Six (12%) EISs discussed cumulative effects in the Introduction, which consisted of definitions, types of cumulative effects and other projects that should be considered. Cumulative effects were discussed more thoroughly in 9 (18%) EISs, comprising a section in the main body of the EIS. In addition, the combined effects of the two projects CTRL and M2 Motorway, were discussed in a separate annex.

7.2.2.2 Scoping

The review examined the process of each EIA. There were 30 (60%) EISs that mentioned conducting scoping: 23 (46%) EISs mentioned scoping and 7 (14%) EISs referred to consultations. Among those that conducted scoping, 8 (16%) EISs prepared scoping reports. Fourteen (28%) EISs mentioned considering *cumulative effects* in scoping. Among these, 9 (64%) EISs were prepared in the year 2000 and 7 (50%) EISs were located in or adjacent to designated conservation sites (such a Sites of Special Scientific Interest (SSSIs), Special Protection Areas (SPAs) and Ramsar sites). In these cases, cumulative effects considerations focused on those valued environmental resources.

The geographical scope for considering cumulative effects was defined at different levels. These ranged from: i) interaction of impacts within the development site (Otterburn, Swale Gateway EISs); ii) cumulative impacts over an area covered by an SPA such as the Orwell and Stour Estuaries (Trinity III Terminal Extension and Proposed New Quays at Ipswich EISs) and iii) combined impacts along a corridor where the two schemes run parallel (CTRL and M2 widening EISs). The geographical scope for the analysis of the visual effects in Wharrels Wind Farm EIS ranged from fixed points (20-21km) away and 'cross-country' (i.e. across the countryside for those travelling through the landscape).

Temporal boundaries for the analysis of cumulative effects have not been mentioned in most of the EISs. However, in the Trinity III Terminal Extension EIS, the temporal range for assessment of cumulative effects was 5 years and so all plans or projects underway or proposed within that time frame were included in the assessment. In the CTRL and M2 widening combined assessment, the temporal boundary was 20 years, which included both the construction and operational phases of both schemes.

In considering past, present and future projects that may interact with the effects associated with the project, the coverage was uneven. There were 28 EISs that considered some aspects: four (8%) EISs discussed past and present projects only and 14 (28%) EISs mentioned present and future projects while others only mentioned other present or past projects. There were 7 (14%) EISs that did not mention other projects. Only 15 (30%) EISs described other past, present and future projects. Relevant future projects identified consisted of: developments where planning permission had been granted, developments where planning permission has been applied for and proposed projects such as those identified in the Local Plan. Sources of information regarding permitted developments were the local authority and for proposed developments, either the Local Plan or Local Studies, such as the Transport Study. Two EISs that provided a more thorough consideration of other projects were the Trinity III Terminal Extension EIS and the Proposed New Quay at Ipswich EIS. The former included all plans or projects underway or proposed within the estuary in the assessment. In the Proposed New Quay EIS, projects considered included developments within and adjacent to the SPA. Developments outside the SPA, but close to it, were considered if their activities (construction noise and movement) would result in potential disturbance to birds.

6.2.2.3 Baseline Conditions

The review examined the description of baseline conditions to assess its extensiveness. Consideration of cumulative effects requires that the affected environment should be defined broadly to include any potentially significant effects occurring away from the immediate project area. Most EISs in the review limited themselves to the immediate area surrounding the project. Characterisation of the affected resources (e.g. air, water, landscape character) was undertaken adequately in most of the EISs.

However, characterisation of stresses was more problematic. Generally, stress factors pertaining to each resource were not adequately considered. Thresholds beyond which

cumulative effects could be significant were based on established standards (e.g. air and water quality). For other impacts where there were no recognised thresholds, such as visual effects, the assessment relied on professional judgement. This was the approach used in the Wharrels Hill Wind Farm EIS and Rochdale EIS.

An EIA that focused the assessment on a particular valued resource is the Trinity III Terminal Extension EIS. The valued resource was the Stour and Orwell Estuaries SPA and the Trinity Marshes proposed SPA. The important features of the resource were the population of waders and wildfowl and the habitat and resources that are required to support them. Key valued environmental components[2] (VECs) included the system hydrodynamics and the extent of the intertidal area. In addition, the combined effect of noise and light disruption to feeding and roosting birds in the vicinity of the development was also considered.

6.2.2.4 Identification, prediction and evaluation of effects

The review investigated the identification, prediction and evaluation of cumulative effects in the EISs. As shown in Table 6.2, there were 15 (30%) EISs that identified cumulative or combined effects and only 9 (18%) EISs provided an analysis, some of which considered cumulative effects on all affected resources (CTRL & M2 widening EISs, Swale Gateway, Ebbsfleet and Otterburn). Three EISs (Trinity III Terminal Extension, Proposed New Quays, Ipswich and Flood Defences Improvement, Southend on Sea) considered cumulative effects on a designated site SPA. The Wharrels Hill Wind Farm focused on landscape character and visual amenity. Those EIAs that considered all affected resources presented a more balanced assessment while those that focused on a particular resource provided a more detailed assessment of cumulative effects on that resource. For instance, the Trinity III Terminal EIS focused on the following hydrodynamic effects: a change in the tidal range; increased accretion in the harbour and the loss of intertidal areas. Cumulative impact modelling was undertaken for relevant projects in the Stour and Orwell Estuaries where it was considered that the impacts of each of the schemes would be large. For schemes with smaller predicted hydrodynamic impacts, the total impact consisted of an estimated sum of the separate impacts of those schemes.

[2] Valued ecosystem components (VECs) is the term used in the US and Canadian literature. This thesis uses the term valued resources, which has a wider application.

Important cause and effect relationships were identified in the Proposed New Quays at Ipswich EIS, where the loss of the intertidal area could cause displacement of birds. Likewise, the Stonecastle Farm Quarry EIS used cause effect analysis to consider potential impacts on receptors (e.g. fauna and flora, soil, water quality) and to examine more closely indirect causes and effects of the primary impacts.

However, out of the 15 EISs that identified potential cumulative effects, 4 (8%) EISs concluded without analysis that these effects were not significant. Uncertainty in impact assessment was mentioned in 9 (18%) EISs while risk was mentioned in 7 (14%) EISs. Transboundary/global issues were mentioned in only one EIS, which was a proposal for a wind turbine. This EIS (Somerton wind farm) referred to the positive effect on air quality that the proposal would bring.

6.2.2.5 CEA methods

The methods used to identify cumulative effects included: professional judgement, matrices and consultations. In the Westhay Heath EIS, a scoping matrix was used to identify potential cumulative effects arising from the projects' activities and key areas, which required further analysis.

Cumulative effects were described qualitatively in 13 (26%) EISs. Some examples where impacts were quantified included: noise impacts in the combined assessment of two EISs (CTRL and M2 widening) and losses of intertidal areas in the Trinity III Port Extension and the Proposed New Quays. Hydrodynamic modelling was used to predict and quantify impacts in two EISs (Trinity III Port Extension and Proposed New Quays at Ipswich). The Wharrels Wind Farm EIS used Zones of Visual Analysis Plans to assess cumulative visual impacts. These were presented during public consultations attended by 250 people where visibility maps and photomontages showing the appearance of the wind farm from a number of vantage points. Subsequently, comments from the public were taken into account in the windfarm design and visitor facility proposal.

A few EISs mentioned the lack of guidance on cumulative effects assessment. The Trinity III EIS mentioned using guidance from the US CEQ and the Rochdale EIS mentioned seeking guidance from the Institute of Environmental Assessment. Only one EIS (Isle of Grain) referred to the EC Guidance on Cumulative Effects (Hyder, 1999)

and it was in reference to the definition of cumulative effects. Table 6.2 shows the EIAs that provided some analysis of cumulative effects.

6.2.2.6 Evaluation of significance

Criteria used to determine significance of impacts were described in 42 (84%) EISs. In most cases, the criteria described in the DOE's *Guidance on the Preparation of Environmental Statements* (DOE, 1995) were followed. The nine EISs that provided an analysis of cumulative effects also evaluated the significance of these effects. The criteria for evaluating significance included: impact magnitude, spatial extent, duration and frequency. For example, the sum of the combined effects of projects on individual species was used in determining the significance of combined effects in the Flood Defences Improvement EIS. In the CTRL and M2 Combined Assessment, the significance of an accumulation of noise effects from construction and off-site rail and road movements on a residential area was based on an aggregation of noise impact calculations. In the Wharrels Wind Farm EIS, the significance of visual impacts was determined by correlating the magnitude of impact with the sensitivity of the receptors (residents, walkers, workers which were graded high, medium or low depending on proximity and activity).

Table 6.2: Project EIAs that addressed cumulative effects

Projects	VECs	Issues/Impacts	Approaches	Mitigation measures	Determination of Significance	Comments
Swale Gateway Devt, 1994 Integrated assessment of four potential property development sites	Landscape character, visual amenity	Impacts upon landscape and views; traffic and disturbance of archaeological remains; water quality; proximity to SSSI	Professional judgement	Landscaping-peripheral screening	Landscape & visual effects not significant	Qualitative assessment of changes in landscape character and views; Considered the combined effects of the four projects within the devt.
CTRL & M2 junctions (1-4) widening, 1994 - high speed railway - road widerning	Landscape character; ancient woodland; agricultural land; surface & groundwater quality	Landscape & visual impacts; loss of ancient woodland; Disruption to farming; Traffic impacts during construction	Professional judgement	Landscaping-screening; fencing; traffic management plans; topsoil collection & reuse	Significant effects: loss of ancient woodlands; visual; heritage; landscape	Qualitative assessment of all affected resources; quantified assessment of noise from operations; Considered the combined effects of the two projects
Ebbsfleet Devt, 1995 -mixed use devt including commercial, residential, leisure and commercial facilities	Landscape character; Visual amenity; Ebbsfleet marshes, SNCI; water resources quality; areas of archaeological interest	Change in landscape character; visual impacts; loss of reedbeds; habitat fragmentation; loss of grassland & vegetation; impacts on surface and groundwater; disturbance to archaeological features; increase in traffic	Professional judgement & use of findings from previous studies	Provision of additional wetland habitats; routing of surface run off; construction code of conduct to minimise cumulative impacts	Significant cumulative impact on Ebbsfleet marshes SNCI	Qualitative assessment of all affected resources; Considered other projects : CTRL, IPS, STDR & Ebbsfleet Devt

Projects	VECs	Issues/ Impacts	Approaches	Mitigation measures	Determination of significance	Comments
Wharrels Hill Wind Farm & Visitor Centre, 2000	Landscape character; visual amenity; tranquility	Increase in incidence of perception of wind turbines; Impacts at fixed points and travelling (cross country effect)	Professional judgement; Analyis of Zones of Visual Influence; reference to public attitudes on wind farms	-	-visual effects not unacceptable	Qualitative assessment of visual impacts; Considered similar devts- three other wind farms
Otterburn Training Area, 1995 -road strengthening & widening; -new facilities for gun spurs; -new accommodation blocks	Landscape character; Visual amenity; recreation; heritage sites	Increase in scale of built development and activities; impact on views	Professional judgement	-	Minor/moderate effect on landscape character; moderate effect on views	Qualitative assessment of impacts on all affected resources; assessed alongside direct and indirect impacts; Considered the effects of different actions within a programme

Projects	VECs	Issues/ Impacts	Approaches	Mitigation measures	Determination of significance	Comments
Trinity Terminal III (Phase 2) Extension, 2000 -quay extension	Intertidal areas; waders and wild fowl & habitats; Stour & Orwell SPAs; water quality in estuary	Loss of intertidal areas; loss of feeding and roosting habitats; decrease in tidal range; Combined impacts from lighting & combined impacts from noise on Trimley marshes p SPA	Hydrological modelling; use of findings from previous studies; professional judgement & consultation		Benefit of 13.7 ha within estuary system; enhancement of 23 ha; loss of 4.6 ha within SPA	Qualitative and quantitative assessment on hydrology and estuarine environment; Considered effects of past, present & future projects w/in or adjacent to the estuaries; 'Appropriate assessment' study
Proposed New Quays in Cliff Quay, Ipswich, 2000 -new quay	Intertidal habitats-Stour & Orwell Estuaries SPA, Ramsar & SSSI	Loss of intertidal areas; increase in rate of intertidal erosion	Hydrological modelling; expert judgement &; use of findings from previous studies	Relocation of dredged material within estuary system	Effects insignificant	Qualitative and quantitative assessment on hydrology and intertidal area; Considered effects of past, present & future projects w/in or adjacent to the estuary; 'Appropriate assessment' study
Flood Defences Improvement, 2000 Southend on sea -improvement of sea defences	SPA/Ramsar sites	Habitat loss; disturbance to birds	Professional judgement		Combined effects not significant over the effects of sea defences	Qualitative asseessment. Considered other future projects in study area. 'Appropriate assessment' study

6.2.2.7 Mitigation, monitoring and management of effects

Most EISs proposed mitigation measures for the project's direct impacts alone. Mitigation measures for cumulative effects were proposed in only 4 EISs. For example, the CTRL and M2 widening combined assessment proposed some mitigation measures to reduce cumulative impacts: i) controls on movements of construction traffic from both schemes were proposed to address the combined community effects on local vehicle travellers and ii) proposals for habitat development were made to address the combined effect of loss of habitats. The Trinity III Terminal Extension EIS proposed the creation of habitat at Trimley Marsh to compensate for the reduction in intertidal exposure from the channel deepening and the terminal extension. However, as indicated in the EIS, it was difficult to predict the cumulative loss of intertidal area within the Estuaries because the outcome of the sediment replacement, habitat creation and beneficial use schemes still had to be determined and the implementation of other future schemes was uncertain. Furthermore, the analysis of the effectiveness of mitigation measures in this EIA did not include the mitigation measures of other project proposals in the Estuary (the Proposed New Quays at Ipswich and Bathside Bay Reclamation).

The effectiveness of the mitigation measures were indicated in 20 (40%) EISs but these referred to mitigating impacts in general and not specifically cumulative effects. Residual impacts after mitigation were mentioned in 47 (94%) EISs. Monitoring proposals were mentioned for some impacts: such as impacts on air, noise or water resources but not particularly for cumulative effects. Only 27 (54%) EISs mentioned monitoring and 12 (24%) EISs indicated that the results of the monitoring programme would be incorporated into the project operations. Management plans to mitigate impacts were proposed in 34 (68%) EISs, but these were for impacts in general and not for the long-term management of cumulative effects.

6.2.2.8 Results of sub samples

In the sub sample of 8 EISs of urban regeneration projects, only 2 EISs considered cumulative effects. This suggests that cumulative effects are not considered adequately in this sector and follows findings from previous studies that the quality of urban development EISs are less satisfactory than other types of projects (Lee and Dancey, 1993). It should be noted, however, that the sample is too small to allow any concrete conclusions.

In the sub sample of 14 EISs in the Thames Gateway, 6 (42%) EISs considered cumulative effects, but two of these were the CTRL and the M2 widening which produced a combined assessment. Although the percentage of EISs that considered cumulative effects in this region is higher than the percentage for the whole sample, the sample is not large enough to allow any generalisation.

Table 6.3 Pairs of project EIAs

Projects	Cumulative effects considerations
1. Thameside Energy Park CHP Plant and Energy Distribution System & Natural Gas Pipeline to Energy Park	Pipeline EIS mentioned cumulative effects but no assessment
2. Kingsnorth Integrated Waste Management Facility & Kingsnorth Integrated Waste Mangement Facility Residue Disposal Site	Both EISs mentioned cumulative effects but no assessment
3. Kings Cross Railways Bills 1 & 2	Both EISs mentioned cumulative effects but no assessment
4. CTRL and M2 (junctions 1-4) widening	A combined effects assessment annex for both projects
5. Ebbsfleet Development & South Thameside Development Route (STDR)	Ebbsfleet Devt EIS provided analysis but STDR EIS did not mention cumulative effects
6. Stockmoor Village & Willstock New Village	No mention of cumulative effects

In the sub sample of eight pairs of EISs, there were only two pairs of EISs that both conducted an assessment of cumulative effects: CTRL & M2 widening and the Trinity III Terminal Extension and Proposed New Quay at Ipswich. In another pair of EISs, one EIS (Ebbsfleet Devt) identified potential cumulative effects though another project that was considered in the Ebbsfleet EIS, the South Thameside Development Route EIS did not mention cumulative effects. In other pairs of EISs, cumulative effects with reference to the other projects were mentioned (Thameside Energy Park and Gas line; Kingsnorth IWMF and Landfill; Kings Cross Bills 1 & 2). Where an existing plan or framework, such as transport plans, are already in place, other projects are then mentioned in the impact study. The Willstock and Stockmore EISs considered each other in terms of studies of transport and hydrology in the area but cumulative effects were not specifically mentioned in the EISs. Table 6.3 shows cumulative effects considerations in the paired EIAs.

6.2.3 Discussion

The results of this review reveal that EISs in the UK continue to fail to address cumulative effects adequately. Only 24 of 50 EIAs (48%) mentioned cumulative effects and most of these EIAs failed to address cumulative effects thoroughly. Ten EISs that mentioned cumulative effects in the introduction did not consider cumulative effects subsequently. Out of the 15 EISs that identified cumulative effects only 9 EISs provided some analysis. Cumulative effects were systematically considered in only three EISs: the combined assessment (CTRL and M2 widening) which considered the two projects, and the Otterburn and Swale Gateway EISs which considered the cumulative effects of the developments within their schemes.

Some findings from this survey are comparable to those from previous reviews of Environmental Assessments (EAs) in the US. A review of 89 EAs by Mc Cold and Holman (1995) revealed that 35 EAs (39%) mentioned cumulative impacts and in a review of 30 EAs by Burris and Canter (1997), 14 EAs (47%) used the term cumulative impacts. Similarly, the results from reviews of Canadian CEA reports (Baxter et al, 1999; Mendoza et al, 2000) found that the standard of cumulative effects assessments undertaken is unsatisfactory.

Of particular concern in this survey is the varied interpretation of what is meant by cumulative effects. This may be because neither the EC Directive nor the UK Regulations provide a definition of cumulative effects. In this sample alone, out of 24 EISs that mentioned cumulative effects, there were eight different definitions provided. In addition, other EISs referred indirectly to cumulative effects as combined effects, in-combination effects and interaction effects. The survey results revealed that the definition of cumulative effects adopted in the EIA determined the scope of the assessment. A narrower definition, such as that of interaction of impacts within the project resulted in the analysis of the cumulative impacts of the project alone while a wider definition, which included other projects (past, present and future) led to a broader geographical and temporal scope.

The relationship between the EIA requirement for the assessment of cumulative effects and requirement for the assessment of in-combination effects under the Habitats Directive needs to be clarified. Some EISs (e.g. Trinity 111 Terminal Port Extension and the Proposed New Quays at Ipswich EISs) have suggested that the cumulative

effects assessment in the EIA could provide the information necessary for the 'appropriate assessment' by the competent authority as required under the Habitats Directive. Most of the EISs that considered cumulative effects were adjacent to or near statutory designated sites, such as European Sites. Out of the 8 EISs that provided an analysis of cumulative effects, three EISs were prepared as part of the appropriate assessment for the Habitats Directive (Trinity III Terminal Extension, Proposed New Quays at Ipswich and the Flood Defences Improvement at Southend on Sea). The assessments of cumulative effects in the first two EISs above were more detailed than the analysis undertaken by all the other EISs in the sample. This may be due to the added protection afforded statutory designations, more specific guidance relating to the Habitats Directive and/or more concern over these affected resources (birds) by environmental organisations.

The survey also found that there was inadequate attention in defining the temporal and spatial boundaries for the study and in identifying other existing and proposed projects in the area. The geographical boundary for most EISs was the immediate area surrounding the project, rather than a broader regional context that might be more appropriate for some of the larger scale developments. This limited spatial boundary precludes the determination of other existing and planned projects and impacts. Information provided by most EISs on other developments was limited, so that their potential additional impact on the affected resource could not be determined. Apart from three EISs (Ebbsfleet Devts, Trinity III Terminal Extension and Proposed New Quays, Ipswich) there was a failure to take into account other past, present and future developments adequately. This applies particularly to future developments, where specific requirements and guidance on what developments to include are lacking. Existing developments were taken into account mostly in the traffic assessments of EISs, which followed the procedure in the guidance (Design Manual for Roads and Bridges Vol 11), (Department of Transport *et al*, 1993). As far as temporal considerations are concerned, these were mostly limited to the construction and start of operation of the project. One difficulty in assessing cumulative effects, as pointed out in the Trinity III Terminal Extension EIS, is that while a regional CEA might be a more appropriate level for assessing cumulative effects (such as for an estuary where many developments are being proposed), this type of assessment may be beyond the scope of a project EIA.

Where an existing framework is available, these have been used to set the context for

the EIAs. For example, cumulative impact studies in the Stour and Orwell Estuary have been used in addressing cumulative effects in two EISs (Trinity III Terminal Extension and proposed New Quays, Ipswich). However, some EISs do not always make use of such frameworks to assess the relative contribution of the proposed project. For example, Kent County Council has developed an air quality model that includes estimates of all major sources of pollution and is regularly updated. The model was used by two EISs for two project proposals in this area (Kingsnorth IWMF and Ridham Dock) to identify other potential sources of pollution in the region, but did not continue the analysis to address cumulative effects. Also, the Bridgwater Transport Study provided the context for the assessment of transport impacts of two proposed housing developments (Willstock and Stockmoor) and the hydrological study for the area was also used in both EISs but the cumulative effects of both projects were not addressed. It appears that the difference between these EIAs and that of the Trinity III Terminal Extension and Proposed New Quays EISs (which conducted CEAs) is the strong emphasis placed on the assessment of combined effects during scoping and consultations in these latter EIAs. Comments from statutory consultees (such as the Ministry of Agriculture, Fisheries and Food, Suffolk County Council, RSPB and English Nature) in the Trinity III Terminal Extension EIS stressed the need for cumulative effects to be assessed. The Proposed New Quay EISs, specifically stated that CEA was undertaken to supply information to allow the competent authority to determine whether the proposed development is likely to have a significant effect on the Stour and Orwell Estuaries SPA as required by the Habitats Directive. Thus, the Habitat Directive seems to be a strong initiating factor for CEA.

The review findings revealed that cumulative effects were mentioned more frequently in recent EISs but the EISs that actually discussed or analysed those effects were not related to when the EISs were prepared. Furthermore, consideration of cumulative effects was not related either to the type of development or geographic location, except when it was adjacent to a protected site. It seems, from this study at least, that cumulative effects assessment is facilitated by two factors: (1) when the projects are part of a development or programme by a single proponent (such as the Otterburn and the Swale Gateway EISs) or (2) when similar projects in the area under consideration are being assessed (Trinity III Terminal Extension and the Proposed New Quays at Ipswich EISs).

This research shows an uneven and inconsistent treatment of cumulative effects in the EISs reviewed and highlights the limitations of project EIAs in addressing cumulative effects. Some of the constraints to CEA recognised in some of the EISs themselves were the uncertainty in regulatory requirements, lack of guidance and access to information on other relevant developments. It is worth noting, however, that in EIAs where the scoping stage considered cumulative effects, these effects were subsequently identified and discussed. This suggests that scoping can play a significant role in ensuring that cumulative effects are considered in EIAs. But more importantly, for cumulative effects considerations in EIAs to improve, these effects should be given equal weight with other factors in the decision-making process.

The Amendment Directive 97/11/EC now provides a clearer opportunity (though not mandatory) for scoping within the EIA process, whereby developers are encouraged to consult with the competent authority and obtain a scoping decision[3]. The most effective driving force for better consideration of cumulative effects is therefore likely to be the local planning authority (and other competent authorities) encouraging developers through better scoping to meet the most recent requirements of the legislation to address cumulative effects. Past arguments that developers were not required to provide information on cumulative effects will no longer be a legitimate excuse now the Amendment Directive 97/11/EC and the UK Regulations have strengthened cumulative effects more on a par with other impacts (Schedule 4 of the 1999 Regulations). This in turn requires a greater awareness of CEA by local planning authority planners and a better understanding of cumulative effects and methodologies for how such effects can be addressed. More tailored guidance for developers and authorities alike is needed for this to happen.

6.3 Review of Environmental/Sustainability Appraisals

After considering cumulative effects considerations in EIAs, the next stage of the research was to assess whether these effects are being considered at strategic level and to what the extent. A review of environmental/sustainability appraisals was carried out to establish how the appraisals were being conducted. The aim of the review was not to criticise current practice but to see how it might be improved by the consideration of overall effects of policies and proposals. The review therefore examined the

[3] Regulation 10, Town and Country Planning (Environmental Impact Assessment) Regulations 1999 (England and Wales).

environmental/ sustainability appraisal processes employed to investigate how CEA can be integrated into that process. The need to consider cumulative effects are recognised in guidance on environmental and sustainability appraisals:

- *A Step by Step Guide to Environmental Appraisal* (Bedfordshire County Council/RSPB, 1996, p6) states that:
  "an environmental appraisal allows specific environmental impact so policies/objectives, as well as the total and cumulative effects, to be clearly demonstrated."

- *The Good Practice Guide on Sustainability Appraisal of Regional Planning Guidance* (DETR, 2000b) suggests that the assessment of cumulative effects should follow the appraisal of direct and indirect impacts and identifies two ways of determining cumulative impacts:
  i) assessing the combined impacts of all policies and proposals on specific areas, for example areas where there are repeated negative impacts
  ii) assessing repeated impacts on specific objectives and targets.

- *The Town and Country Planning Association's Guide to Sustainability Appraisal* (2002) suggests that cumulative effects arising from the interaction of policies and proposals should be considered.

6.3.1 Method

Fifteen Sustainability/Environmental Appraisals were reviewed to assess the extent to which and how cumulative effects were considered in development plans. There were seven environmental appraisals and eight sustainability appraisals prepared between 1996 and 2002. The samples were collected from April 2001 to June 2002. The sample consisted of appraisals prepared for unitary development plans (8), local development plans (5), county development plans (2) and regional plans (2) in the Thames Gateway area. The sample was limited to appraisals undertaken in the Thames Gateway in order to establish a context of appraisals practice in the case study area and was all that were available in the Thames Gateway at that time. A list of appraisals reviewed is included in Appendix 3.

Review criteria were developed based on the evaluation criteria to assess the integration of CEA into SEA by Kotze (2001) and existing guidance in the UK, which refer to

cumulative effects (the guidance mentioned above in Section 6.2). The Review criteria are listed in Appendix 4.

6.3.2 Results

Two sustainability appraisals mentioned the term cumulative effects: the Interim Sustainability Appraisal for the Kent County Council (KCC) and Medway Council (MC) Structure Plan (2002) and the Essex County Council Environmental Appraisal (1998). Reference to cumulative effects is found in Appendix 1 of the Environmental Appraisal (Essex County Council, 1998), which lists policies contained in the Draft Deposit Plan. Policy BE 7 states that the adverse impact of development should be minimised and where the impacts of the proposed development are likely to be significant, an Environmental Assessment should be required. If the Assessment demonstrates that the impacts cannot be reduce to acceptable levels, or "*if the cumulative impacts of a proposed development taken together with other existing development is unacceptable, then the proposed development will not be permitted*" (Essex County Council, 1998, p. 73). This appraisal adopted a strategic environmental assessment process for considering policy impacts and mentioned that direct, indirect, immediate and long-term impacts were taken into account.

The KCC and MC Interim Sustainability Appraisal, which was prepared to accompany the Policy Directions Document, included the "consideration of cumulative and long term effects" (KCC and MC, 2002 p. 3). A summary of the results of the review is shown in Table 6.4.

Since the review was completed, the final Sustainability Appraisal (SA) of the Kent and Medway Structure Plan has been prepared (KCC and MC, 2003). It included 3 key stages: i) Development of the Sustainability Appraisal Methodology, ii) Pre-Deposit Consultation and Interim Appraisal, iii) Drafting the Structure Plan and Chapter, Internal and External Appraisals. The SA has been conducted simultaneously during all stages of the Plan's preparation. The approach for the Appraisal included among its parameters "consideration of secondary, cumulative and long-term effects" and so cumulative effects were considered during each stage of the process (KCC and MC, 2003, p5).

Stage three of the appraisal consisted of two components: an internal and external appraisal. The internal appraisal required that "*consideration be given to the full cumulative impact of housing, development and transport infrastructure proposals on the environment and resources...*" (Ibid, p. 14). The external sustainability appraisal (undertaken by a group of experts with sustainability experience at District, County or Regional levels) noted: "*an overall assessment of the cumulative impact/effectiveness of the proposed transport strategy is required*" (Ibid, p16). The *Kent and Medway Sustainability Appraisal Working Paper no 15*, which documents the stages of the Appraisal process, stated that the assessment of cumulative impacts of transport, employment and housing as one of the key achievements of the appraisal process (Ibid, 2003). However, the report does not provide any details of the assessment. The Deposit Plan is currently under consultation and one of the sustainability issues for which views are being sought include the following issue: "*Is the individual and cumulative impact of greenfield 'housing, transport and employment' development acceptable?*" The approach adopted for the sustainability appraisal is an iterative process and the findings from the consultation process will inform any further changes to the plan and the appraisal.

Most of the appraisals identified impacts relating to three general criteria: Global Sustainability, Natural Resources and Local Environmental Quality. Under each of these criteria, there are sub criteria, as specified in the *Environmental Appraisal of Development Plans: A Good Practice Guide* (DETR, 1993), which sets out a framework and methodology for the appraisal (see Section 5.4.2). There are three stages in the appraisal: defining environmental stock, scoping and policy appraisal. The two elements of the appraisal are: a consistency analysis which tests the compatibility of policies and a policy impact matrix, which tests the policy against the general criteria.

Some local authorities (such as Greenwich Council, 2002; Lewisham Council, 2002) extended this environmental assessment framework to include social and economic factors in preparing their sustainability appraisals. There were five local authorities that conducted environmental appraisals and the rest undertook sustainability appraisals.

The baseline for the appraisals used State of Environment reports, which catalogue the condition of the environment in the area or a characterisation of the environment through an assessment of environmental stock. Policies were examined to see if they

have a positive or negative impact on the stock. Designated sites were a primary concern in considering potential impacts of policies.

Table 6.4 Summary of results of appraisals review

Planning Authority and Plan	EA/ SA	Stage initiated	Scoping Setting boundaries	Identification of likely significant impacts	Identification of other actions	Characterisation of environment & baseline studies	Identification of valued resources	Criteria/ indicators	Mitigation	Monitoring	Consultations during appraisal
LB Barking & Dagenham UDP (1999)	SA	–	✓ scoping part of review process	✓	×	State of Environment Report	✓ designated sites	Sustainability criteria	✓ develop new policy	✓ monitoring of sustainability objectives	✓
Basildon District Local Plan (1998)	SA	Integral to the preparation of modifications to the Plan	–	✓	×	State of Environment Report	✓ key assets	Environmental indicators	–	×	✓
Bexley UDP (2000)	EAp	Appraisal of proposed alterations to the Plan	✓	✓	×	Environmental Stock	✓ designated sites	Environmental stock criteria	–	×	–
Dartford Borough Local Plan Review – Deposit Draft (2000)	SA	Commenced at outset of 1st draft & modified during 2nd draft	– appraisal limited to Borough wide impact	✓	×	–	✓ designated sites	Sustainability criteria	New & replacement policies	×	✓
Gravesham Borough Local Plan 2nd review (2000)	SA	–	–	✓	×	–	✓ designated areas	Sustainability criteria	–	×	–
LB Greenwich UDP (2002)	SA	Integral to preparation of 1st deposit draft	✓	✓ assessed compatibility of policies & impact of all policies against environmental stock criteria	×	✓ Environmental stock	✓ designated areas	Environmental stock criteria Indicators of positive impact	–	×	–

LD Lewisham UDP (2000)	SA	Undertaken during deposit draft preparation	✓ scoping for appraisal undertaken during preparation of issues papers	✓ assessed compatibility of policies & impact of all policies against environmental stock criteria	×	✓ Environmental stock	✓ designated areas	Environmental stock criteria, Indicators of positive impact	–	×	–
Planning Authority	**EA/ SA**	**Stage initiated**	**Scoping Setting boundaries**	**Identification of likely significant impacts**	**Identification of other actions**	**Characterisation of environment & baseline studies**	**Identification of valued resources**	**Criteria/ indicators**	**mitigation**	**Monitoring**	**Consultations during appraisal**
LB Newham UDP (1996)	EAp	After the UDP, Inquiry & before the receipt of the Inspector's report	✓	✓	×	State of Environmental Report	✓ designated areas	Environmental criteria Key indicators	✓	✓ Monitoring of key indicators	–
LD Redbridge UDP (1997)	SA	Examines UDP policies adopted in 1994	✓	✓	× Recommended the consideration of other plans	Environmental stock	✓ designated areas	Environmental stock indicators	✓ create stronger policy framework	×	–
Swale Borough Local Plan (1996)	SEA	–	–	✓	×	Environmental stock	✓ designated areas	General Criteria	–	×	–
LB Tower Hamlets (UDP) (2002)	EAp	Appraisal first stage of review process of Plan adopted in 1998	–	✓	×	Environmental stock	✓ environmental resources, historic assets	Appraisal criteria	Alter policy	×	–
Kent & Medway Structure Plan Future Policy Directions (2002)	SA	Integrated at all stages of Deposit Plan preparation (Interim appraisal of future policy directions (March 2002)	✓	✓ secondary, cumulative & long term effects	RPG 9	Characterisation of environment	✓ designated sites; AONBs/Special Landscape Areas biodiversity interests	Targets & indicators and objectives from Regional Sustainable Devt Framework & decision-making criteria	Link policies, strengthen some policies	✓ monitoring of housing provision	✓ External workshop with a wide range of stakeholders
Essex County Council Draft Deposit Plan (1998)	EAp	SEA as part of the Plan process	✓	✓ direct & indirect impacts	×	Sustainability Report & State of the Environment Report	✓ sites of landscape significance	Sustainability Indicators Environmental criteria	Alternative development strategies	✓ monitoring proposed to examine future trends	–

Draft London Plan (2002)	SA	Started after the preparation of the 'Towards the London Plan 'document but before detailed policies have been prepared	✓	✓ - direction of effect: towards or away from sustainability - timing: during plan period or beyond: - severity and scale of effect	×	×	✓ environmental assets	Objectives	–	×	✓ Consultations with key stakeholders
Planning Authority	**EA/ SA**	**Stage initiated**	**Scoping Setting boundaries**	**Identification of likely significant impacts**	**Identification of other actions**	**Characterisation of environment & baseline studies**	**Identification of valued resources**	**Criteria/ indicators**	**mitigation**	**Monitoring**	**Consultations during appraisal**
Regional Planning Guidance for the Southeast Draft RPG 9 (2000)	SA	Appraisal of changes to the draft RPG 9.	✓	✓	×	×	✓ designated areas	Sustainability framework objectives	–	×	–

Abbreviations: LB: London Borough UDP: Unitary Development Plan SA: Sustainability Appraisal EAp: Environmental Appraisal SEA: Strategic Environmental Appraisal

The DETR (1993) guide suggested that information on environmental stock could be compared to specific standards or targets, such as air quality standards by the EU, water quality standards by the Environment Agency or biodiversity targets by English Nature. Targets and indicators were discussed in six appraisals. Indicators of positive impact listed in the DETR Guide were used in two appraisals (Greenwich Council, 2002 and Lewisham Council, 2000) while one appraisal, prepared by Redbridge Council (1997) developed their own list. Newham Council identified key indicators for identifying changes in the environment (Newham Council, 1996). An example of a key indicator, which needed monitoring in order to determine whether the Borough was becoming more sustainable over the Plan period is shown in Table 6.5.

Table 6.5 An example of a key indicator

Indicator: Provision of open spaces	Indicators to be monitored
Amount of public open space	Whether there is an increase or decrease in amount of public open space (approximately 252 hectares in 1995)
Access	Length of Thames-side accessible to the public (0.75km or 10.3% of Thames-side in Newham in 1995)
'green chain' network	Length of green chain completed

Source: London Borough of Newham Environmental Appraisal (1996)

Only one planning authority appraisal mentioned the need to undertake 'environmental capacity' studies but none of the appraisals actually carried any out. Monitoring was mentioned in four appraisals:

- Newham Council EA mentioned monitoring of key indicators;
- Kent and Medway Structure Plan Interim SA mentioned monitoring of housing provision;
- Essex County Council EA mentioned monitoring of future trends.
- Barking and Dagenham SA mentioned that sustainability objectives needed to be monitored.

Two appraisals mentioned carrying out consultations with stakeholders in preparing the appraisals (KCC and MC SA and the Greater London Authority SA). The Redbridge Sustainability Appraisal mentioned the need to consider other plans. None of the appraisals mentioned assessing the potential effects of the plan under consideration and other relevant plans. The Kent and Medway Council took into account the housing provision requirements under the Regional Planning Guidance for the South East (RPG 9) but not the combined impacts of policies or proposals from both plans. Six

appraisals referred to mitigation measures, such as the development of new policies or the replacement of policies.

6.3.3 Discussion

There was a lack of detailed consideration of cumulative effects in all the appraisals. This situation is perhaps not unique in the Thames Gateway area. *The Interim Planning Advice on the Environmental Assessment of Plans* (Scottish Executive, 2003) noted that there have been no detailed cumulative impact assessments completed for development plans in Scotland at the time that the advice was drafted. Although cumulative effects may be referred to in appraisals, an assessment does not necessarily follow. For example, one appraisal that mentioned cumulative impacts is the Cambridgeshire and Peterborough Structure Plan Review: Sustainability Appraisal. This appraisal stated: "*additional infrastructure associated with major developments will have a **cumulative impact** on the environment*" (Land Use Consultants et al, 2002, p 65). But the appraisal did not provide any details of how cumulative impacts were addressed.

The lack of consideration of cumulative effects may be due to several reasons. Firstly, the guidance followed in 13 of the appraisals, PPG 12 and the *Guide on Environmental Appraisal* (DETR, 1993) made no mention of cumulative effects. Although two appraisals (the London Plan SA and the draft RPG 9 SA) used the *Good Practice Guide on Sustainability Appraisal of Regional Planning Guidance* (DETR, 2000b), which refers to cumulative effects, these appraisals did not consider cumulative effects. Secondly, assessing cumulative effects is not legally required in appraisals. Thirdly, the procedure proposed in the DETR guide is focused on compatibility of policies and proposals and impacts are appraised against objectives, which does not allow consideration of cumulative effects (see Section 5.4.2). Characterisation of stock may be useful in the initial stages of an assessment, but it does not have the required level of detail for CEA. CEA requires a more detailed level of baseline condition of the environment and selected resources, including thresholds and capacity limits on which additional impacts can be assessed.

Fourthly, CEA is a relatively new field in the UK and there is a lack of guidance and experience on assessing cumulative effects at strategic levels. In Canada and the US where there have been more experience of environmental assessment, most of it has been at the project level. Most of the guidance on CEA (US CEQ, 1997; Hegmann et

al, 1999 and Hyder Consulting, 1999) is focused on project level assessments. Although some guidance at strategic level has been produced, these have focused on specific sectors (e.g. Guide on assessing the cumulative impacts of a park management plan (Kingley, 1997) and the *Guide to Assessing the Cumulative Effects of Wind Energy Development* (ETSU, 2000) focusing on the combined effects of several windfarm developments). These guidelines did not integrate CEA into the land use planning process.

However, there is increasing attention on assessing cumulative effects at strategic levels because of the EU SEA Directive requiring the assessment of cumulative effects of plans. For example, the Sustainability Appraisal Guide has been refined and among the main changes is the expansion of the advice on scoping and appraising cumulative impacts (ODPM, 2003). It suggested that appraisal of cumulative effects should follow the method used for options and policies and the potential impacts of combinations of policies and induced impacts need to be assessed against sustainable development objectives. It stressed that cumulative effects of policies needed to be explored since in combination they may lead to a crossing of thresholds.

For the above reasons and others that will be discussed below, CEA seems to fit better within SEA than sustainability appraisal. Firstly, the SEA Directive requires that other plans should be considered, so that the overall effects can be assessed. Secondly, the SEA process puts more emphasis on the baseline condition and threshold, against which cumulative effects can be assessed. Thirdly, the SEA process is closely related to CEA, being from the same environment assessment family.

Since the above appraisals have been prepared, government guidance has been issued that deal specifically with cumulative effects as part of SEA of plans: *Strategic Environmental Assessment Directive (2001/42/EC): Guidance for Planning Authorities* (ODPM, 2003) and the *Environmental Assessment of Development Plans: Interim Planning Guidance* (Scottish Executive, 2003). Both these sets of guidance propose a matrix approach, with proposals set against resources that might be affected by the proposals. Furthermore, the ODPM SEA guidance for England suggests the use of network analysis in identifying and assessing cumulative impacts. However, to assist planning authorities in assessing cumulative effects, more detailed guidance on CEA at strategic level is required. Such guidance needs to address some of the constraints in

assessing cumulative effects at strategic level: conceptual, methodological, technical and the lack of an appropriate framework for integrating CEA into strategic planning.

6.4 Summary

This chapter described the results of the consideration of cumulative effects in project EIAs and in plan appraisals. The findings from the reviews show poor consideration of these effects at both levels. Some of the reasons for this have been explored, such as the lack of understanding of the concept, the lack of guidance and the limitations of project EIAs in addressing these effects effectively. This part of the research therefore established to what extent and how cumulative effects were considered in project and plan environmental assessment practice.

Assessing these effects at a strategic level and at an earlier stage of the planning process where alternatives can be considered in terms of cumulative effects seems a more promising approach. Also, the gradual degradation from a range of activities, which are not covered by the EIA Regulations, can be assessed at strategic level. However, appraisals as currently practiced would need to change if they are to address cumulative effects effectively. SEA has been promoted as a means for addressing cumulative effects and the next chapter explores SEA as a context for CEA.

SECTION III – DEVELOPING THE STRATEGIC CEA FRAMEWORK

Chapter 7. Strategic Environmental Assessment

7.1 Introduction

This chapter introduces the concept of strategic environmental assessment (SEA). It briefly discusses the principles and procedures in SEA and its application in the UK. The relationship between CEA and SEA is explored. The final sections outline the requirements of the EU SEA Directive and its implications for planning.

7.2 Definitions of SEA

SEA has been defined as a process of assessing, at the earliest possible stage, the environmental impacts of decisions made at policy, planning and programme level (Partidário, 1996). A definition that emphasises the role of SEA in ensuring that environmental consequences are included in decision-making is provided by Sadler and Verheem (1996, p. 27):

" SEA is a systematic process for evaluating the environmental consequences of proposed policy, plan or programme initiatives in order to ensure they are fully included and appropriately addressed at the earliest appropriate stage of decision making on par with economic and social considerations".

Furthermore, SEA has been defined as: *"a structured, proactive process to strengthen the role of environmental issues in strategic decision-making"* (Verheem and Tonk, 2000, p.177).

Another definition has focused on procedural aspects:
" the formalised, systematic and comprehensive process of evaluating the environmental effects of a policy, plan or programme and its alternatives, including the preparation of a written report on the findings of that evaluation, and using the findings in publicly accountable decision-making" (Thérivel et al, 1992).

Thus, SEA is an environmental assessment process that applies to policy, plans and programmes (PPP) to assist decision-making at strategic levels. Policies can be defined as *"an inspiration and guidance for action"*, a plan as *"a set of coordinated and timed objectives for the implementation of policy"* and a programme as *"a set of projects in a particular area"* (Wood and Dejeddour, 1992, p.8). Generally, there exists a tiered

planning process which starts with the formulation of a policy, followed by a plan and then by a programme.

7.3 Types of SEA

SEA has evolved into a range of forms as shown in Box 7.1. These SEAs address certain types of actions. Actions that do not result in projects but can have significant environmental impacts (e.g. agricultural practices) could be addressed at policy level or through regional or area based SEAs.

Box 7.1 Types of strategic environmental assessment

- Policy SEA – process of evaluating policy proposals
- Regional or area based SEA – determines the environmental implications of multi-sectoral developments within a defined geographical area, over a certain period (e.g. regional or land-use development plans).
- Sectoral SEA – evaluates the environmental implications of sector policies, plans or investment programmes involving multiple projects (e.g. mineral extraction, energy, tourism).
- Programmatic SEA – evaluates groups of actions related geographically or having similarities in project type or timing

Sources: adapted from Thérivel and Pártidario, 1996 and Pártidario, 1999.

7.4 The need for SEA

There are two main reasons for SEA: i) SEA addresses some of the limitations of project EIA and ii) it promotes sustainable development (Lee and Walsh, 1992; Wood and Dejeddour, 1992; Thérivel and Partidário, 1996; Shepherd and Ortolano, 1996; Stinchcombe and Gibson, 2001). Project EIAs occur too late in the planning process to ensure that all the relevant alternatives and impacts are adequately considered (Wood and Dejeddour (1992). Project EIAs are usually limited to the project's direct impacts and do not adequately consider cumulative, indirect or induced impacts (see Section 4.5.2).

In terms of alternatives, those that project EIAs can address are rather limited. EIAs typically address two alternatives: those relating to the construction and operation of a project and the project not being approved (Canter, 1996). Furthermore, alternative designs rather than a range of approaches are considered in EIAs (Steinemann, 2001). For example, different transport alternatives, such as modes of transport can be

considered at policy or plan level, while an EIA of a road link will only consider alternatives in terms of alignment.

Similarly, mitigation measures proposed in project EIAs are limited. EIAs are usually submitted to obtain planning permission for a particular site, so mitigation measures can be required only for those impacts relating to the project itself, which means that indirect or secondary impacts resulting from the project can be left unmitigated. SEA, however, can consider policy-level alternatives and programme-wide mitigation measures (Shepherd and Ortolano, 1996).

Also, Project EIA does not address the additive effects of many small projects that do not require an EIA, such as small housing developments or agricultural management schemes, but taken as a whole, may have significant effects. SEA would allow these effects to be better considered because it occurs at an earlier stage in the decision-making process and takes account of a broader range of actions and impacts (i.e, cumulative, secondary and indirect impacts) over a greater area (Thérivel et al, 1992; Shepherd and Ortolano, 1996). Bonnell and Storey (2000) suggested that SEA could be used to address potential cumulative effects at various stages of the decision-making process. Thus, SEA has been promoted as an appropriate framework for addressing cumulative effects.

The World Bank, for example, uses Sectoral and Regional Environmental Assessments (EAs). Sectoral EAs are particularly useful for considering the cumulative impacts of relatively small, similar projects planned in the same sector which do not merit individual project EIAs (World Bank, 1993). It avoids the limitations of project EIAs in addressing issues related to policy, planning and the institutional framework; provides opportunities for considering alternatives; allows for comprehensive planning of sector-wide mitigation and monitoring and provides a framework for considering cumulative effects (Ibid, 1993).

Regional EAs examine environmental impacts associated with a particular strategy, policy, plan, programme or a series of projects for a particular region (e.g. urban area, watershed or coastal zone). Regional EAs are used where a number of significant development activities with potentially cumulative impacts are planned for a particular area (World Bank, 1996). It provides a framework for the CEA of several different

projects in a specific region and allows comprehensive planning of region-wide environmental management and monitoring (Ibid, 1996).

Another advantage in using SEA is in public involvement. SEA facilitates consultations between authorities and enhances public involvement in the evaluation of environmental aspects of PPPs (Wood and Dejeddour, 1992). Early consultation helps to address problems relating to SEA-related issues at the start of the planning process and prevents future delays of actions due to public opposition (Sheate, 1996) and increases public acceptance and support (Fisher, 1999).

Furthermore, SEA can help refocus, streamline and strengthen project EIAs (Sadler and Verheem, 1996; Fischer, 1999). SEA can help clarify and establish a policy framework against which project EIAs can be conducted effectively. It could shorten and simplify project EIA by reducing the amount of work at project level: the information and analysis undertaken in the SEA can be used in scoping of EIAs and some activities that have been assessed earlier in the planning process may not require project-level assessment (Lee and Walsh, 1992; Fischer, 1999).

Apart from addressing the limitations of Project EIA, SEA can promote sustainable development by integrating environmental concerns into policy and planning processes. SEA uses "tiering" so that higher-level SEAs can cover issues that can be analysed in lower level EIAs. Thus, an SEA framework should allow the principle of sustainability to be carried through from policies to individual projects (Thérivel and Partidário, 1996) and assist in the design of policies and strategies (Partidário, 1996). The benefits of SEA has been discussed extensively in the literature (Wood and Dejeddour, 1992; Partidario, 1996; Fischer, 1999 and Partidario, 1999). Stinchcombe and Gibson (2001) identified ten advantages of SEA for sustainability, as set out in Box 7.2.

Box 7.2 Ten advantages of SEA for sustainability

SEA:

1. provides a process for integrated pursuit of sustainability objectives in policy making and planning
2. provides a process for integrated pursuit of sustainability objectives in policy making and planning
3. operationalises sustainability principles
4. improves the information base for policy making, planning and programme development
5. is proactive and broad in ways that strengthen consideration of fundamental issues
6. improves analysis of broad public purposes and alternatives
7. facilitates proper attention to cumulative effects
8. facilitates greater transparency and more effective public participation at the strategic level
9. provides a framework for more effective and efficient project level assessments
10. provides a base for design and implementation of better projects where project level assessment is not required.

Source: Stinchcombe and Gibson (2001)

However, there are limitations to SEA, which are political, technical and procedural in nature (Glasson, 1995; Partidario, 1996; Thérivel and Partidário, 1996). Since SEAs cover a large area, there are problems in collecting and analysing data and a greater number of alternatives to be considered. Barriers to SEA in terms of sustainability include the following: unavoidable uncertainties; boundary-setting complexities; primitive methodologies; difficulties in defining the role of public participation; integrating SEA with other assessment processes; institutional resistance; limitations of the rational planning and policy making model; and resistance to integration of SEA in core decision-making (Stinchcombe and Gibson, 2001).

7.5 Principles of SEA

In the literature, guiding principles have been put forward for SEA relating to: frameworks and processes. Principles of SEA frameworks include: clear legal provisions for SEA; agency accountability; tiered SEA system; clear objectives and terms of reference; it should be proactive and applied in the PPP decision-making process as early as possible (Sadler and Verheem, 1996 and Pártidario, 1996).

Principles of SEA processes usually consist of a set of procedural or content requirements. A comprehensive set of principles for good practice of SEA included policy, institutional and procedural components (Pártidario, 1999). Process principles included sustainability factors (physical, ecological, socio-economic, institutional and political). Another set of process principles formulated focused on goals rather than process requirements (Verheem and Tonk, 2000). Verheem and Tonk (2000) examined two forms of SEA based on their proposed SEA principles: Dutch 'strategic EIA' process (SEIA) and the Dutch 'E-test'. The former relates to spatial and sectoral plans

and programmes while the latter relate to drafting legislation. They found that different processes could come from the application of the same principles. Examples of SEA principles are set out in Box 7.3.

A comparison of both principles shows that Sadler's set of principles would be a useful guide to those preparing and undertaking an SEA while Verheem and Tonk's SEA principles would be helpful in checking the quality of the process against goals. SEA guiding principles have also been set in Canada for agencies and departments, to guide the implementation of the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals* (CEAA, 2000). These succinct but practical guidelines include: early integration, examine alternatives, flexibility, self-assessment, appropriate level of analysis, accountability and use of existing mechanisms.

Box 7.3 Examples of SEA process principles

Process based (Sadler, 1996)

- *initiating agencies* are accountable for assessing the environmental effects of new or amended policies, plans and programmes
- the assessment process should be *applied as early as feasible* in proposal design
- *scope of the assessment* to be commensurate with the proposal's potential impact or consequences for the environment
- *objectives and terms of reference* should be clearly defined
- *alternatives* to, as well as the environmental effects of , a proposal should be considered
- *other factors*, including socio-economic considerations, to be included as necessary and appropriate
- *evaluation of significance* and determination of acceptability to be made against policy framework of environmental objectives and standards
- provision should be made for *public involvement*, consistent with potential degree of concern and controversy of proposal
- *public reporting* of assessment and decisions (unless explicit, stated limitations on confidentiality are given)
- inclusion of environmental factors in *policy making*
- *tier processes*, where possible, to subsidiary SEA and project EIA
- *monitoring and follow-up of measures*, including tracking proposals that initiate further actions
- need for *independent oversight* of process implementation, agency compliance and government-wide performance

Goal focused (Verheem and Tonk, 2000, p.179)

	An sea process ensures that:
Screening	an appropriate environmental assessment is carried out for all strategic decisions with potentially significant (positive or negative) environmental consequences by the agencies initiating these decisions
Publication	it is clear to all parties affected by the decision how the assessment results were taken into account when coming to a decision
Monitoring	sufficient information on the actual impacts of implementing the decision is gained to judge whether the decision should be amended
Timing	the results of the assessment are available sufficiently early to be used effectively in the preparation of the strategic decision
Environmental scoping	all relevant environmental information is provided, and all irrelevant information is excluded, to judge whether an initiative should go ahead or whether the objectives of the initiative could be achieved in a more environmentally friendly way
Socio-economic scoping	sufficient information on other factors, including socio-economic considerations, is available, either parallel to, or integrated in, the assessment
Views of the public	sufficient information is available on the views of the public affected by the strategic decision early enough to be used effectively in the preparation of the strategic decision
Documentation	the results of the assessment are identifiable, understandable and available to all parties affected by the decision
Quality review	the quality of the process and information is safeguarded by an effective review mechanism

7.6 Approaches, process and methods

7.6.1 Approaches

Two approaches have been used to apply SEA to strategic decisions (Partidario, 1996). First, project EIA's scope is extended to higher-level assessments of policies, plans and programmes. Second, a policy and planning rationale is adopted where sustainability principles are established and these are applied at policy, plan and programmes (PPPs). However, SEA has often evolved in the former manner, rather than the latter, which may be due to EIA methods being more established (Sheperd and Ortolano, 1996). But for the SEA process to be effective, it needs to begin at the policy level and "trickle down" to lower levels of PPP-making (Thérivel and Partidário, 1996, p. 12). These two approaches need not be completely separate but could merge into a more useful SEA and Sheate *et al* (2001) shows how this might be. The two approaches - EIA driven and objectives-led can be complementary, combining to provide "integrationary SEA", where an objectives-led appraisal is strengthened by improved baseline knowledge and public participation (Sheate *et al* , 2001).

Partidario (1999) identifies some factors, which influence the nature and characteristics of an SEA system: policy-making/planning and decision-making and EIA. The policy-making/planning dimension refers to the structure and response of policy and planning systems to the incorporation of SEA. The linear model follows a rational, problem-led planning approach and follows a sequence of activities in which SEA fits in. A cyclical planning model follows a strategic approach, which tends to be more flexible. In this case, SEA will tend to adapt to ongoing circumstances, based on discussions among the various actors in the process.

The decision-making process is another factor that will affect the implementation of SEA. Researchers have stressed the need for a better understanding of decision-making processes and the implications of these for SEA (Kørnøv and Thissen, 2000; Nilsson and Dalkmann, 2001; Nitz and Brown, 2001). Nilsson and Dalkmann (2001) observed that existing SEA approaches are frequently based on the EIA model, which is conceived from a rational perspective on decision-making. A rational decision-making process usually follows the following sequence: framing the problem, defining key objectives, establishing alternatives, identifying consequences and clarifying trade-offs (Nilsson and Dalkman, 2001). These authors observed that most environmental assessment frameworks, guidelines and practices follow this rationalist model.

However, this model of decision-making is a normative one and experience has shown that decision-making processes in practice do not always follow such a procedure (Kørnøv and Thissen, 2000).

Nilsson and Dalkmann (2001) noted that most decision-making processes at strategic levels are characterised by "bounded" rationality; that is, rational decision making constrained by cognitive and resource limitations as well as other factors, such as institutional norms, behavioural and political aspects. These authors suggest a decision-centred SEA that is adaptive and flexible and uses tools and approaches that address such constraints. They contend that to be effective, the assessment should take the real decision making process as the departure point for SEA. Similarly, Kørnøv and Thissen (2000) suggested that the SEA should be guided by insights into the nature of decision processes and the ways to influence such processes. In the context of SEA of policies, Nitz and Brown (2001) argued that in order to make that process effective, SEA must influence the decisions that are intrinsic in policy making. Therefore, EA practitioners need to be more aware of the policy-making process and SEA procedures should be designed to fit into existing policy-making activities. Such a requirement should also apply in other forms of SEAs.

Besides the planning and decision-making processes, another factor that could influence the SEA system is the traditional EIA perspective. This sees the SEA system as a new form of EA, which can influence the form and integration of SEA into traditional decision-making (Pártidario, 1999). As a result, existing EIA legal procedures, requirements and methodologies are applied to SEAs of policies and plans.

Several classifications of SEA systems have been developed. In 1993, Thérivel identified and reviewed five SEA systems with different legal, institutional and methodological approaches. Sadler (1996, p. 149) identified three process models of SEA systems:

- standard (*EIA-based*) model – SEA of policies, plans, and/or programmes patterned after the the EIA process with similar steps and activities but with differences introduced by more fluid policy requirements (as in Denmark).
- equivalent (*environmental appraisal*) model – policy and plan evaluations, undertaken to identify and take account of environmental effects (as in the UK); and

- integrated *(environmental management)* model – undertaken as an integral part of a comprehensive policy and plan setting process (as in New Zealand).

From a regional planning perspective, Glasson and Gosling (2001) identified a set of models of SEA and regional planning based on integration of these two processes. These range from very limited integration to full integration and include the following:

- initial '*incremental*' model in which project EIA techniques can be applied;
- *stapled* model where SEA is carried out at a stage of the planning process and is a separate activity;
- *concurrent* model, where the SEA is undertaken at the various stages of the plan-making process; and
- *holistic* model, where there is full integration of environmental concerns into the planning process and there is no separate SEA process.

Applying these models against SEA approaches in three European countries, Glasson and Gosling classified SEA as *incremental* in the Netherlands, *stapled* in Spain and *concurrent* in England. They concluded that a holistic model could come from the concurrent model, representing an iterative and multi-staged but 'weaker' approach to SEA towards a more comprehensive form of sustainability appraisal.

More recently, Sheate *et al* (2003) identified four models of SEA based on an analysis of environmental integration in 20 case studies and SEA's role within it:

- ***EIA- inspired SEA*** in which the impacts of a preferred option are assessed against the baseline and there is more emphasis on technical methodologies. This model is particularly used at the programme level.
- ***Policy analysis/appraisal-inspired SEA*** in which impacts of a preferred option are appraised against objectives and there is no baseline survey and little direct public participation. This model is often used in regional and land use planning.
- ***'Integrationary' SEA*** in which impacts are appraised against a combination of a baseline survey and objectives.
- ***Ad hoc mechanisms of environmental integration*** in which there is no systematic process but environmental considerations are integrated into decision-making processes through other mechanisms.

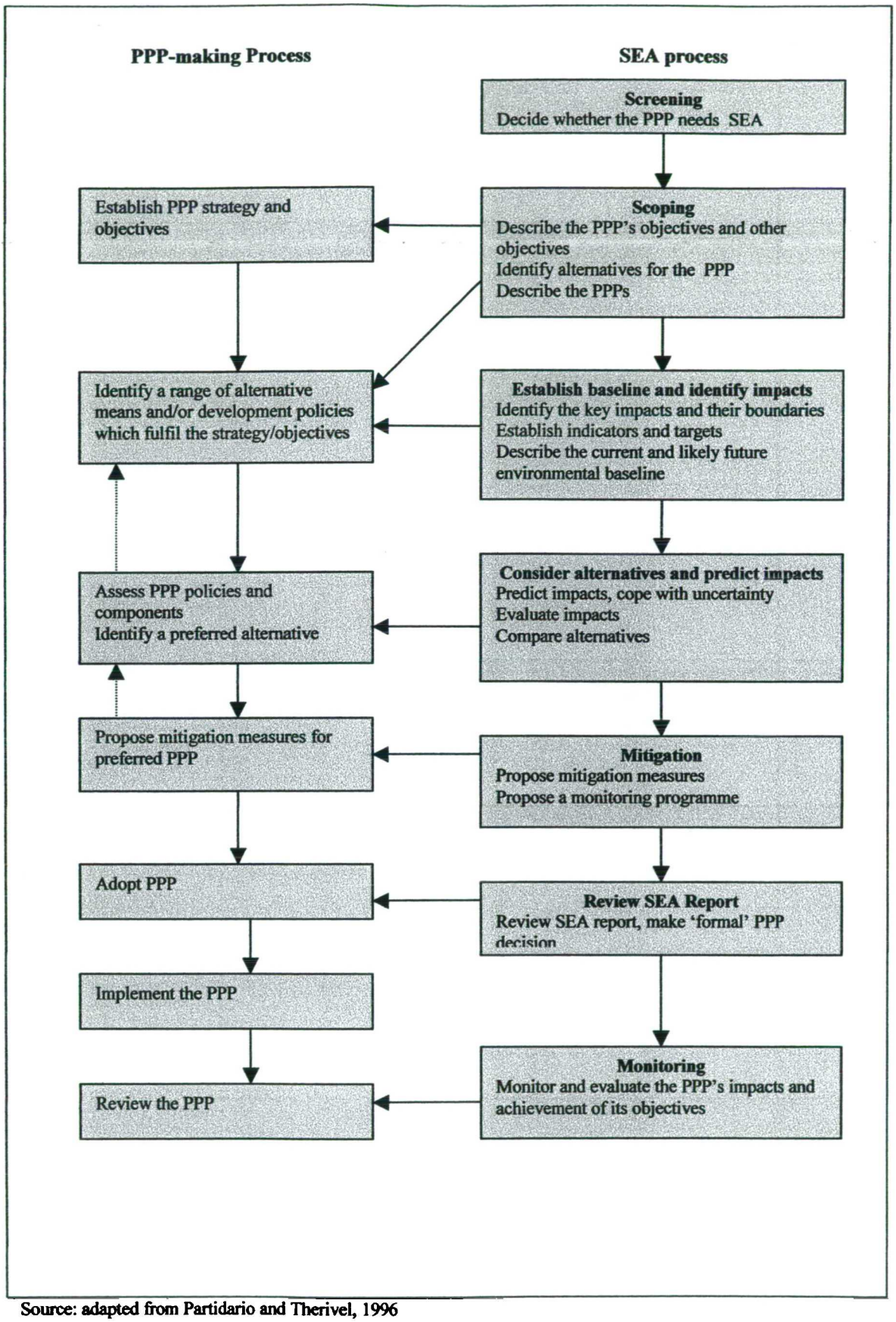
Sheate *et al* suggested that, in theory, integrationary SEA is the optimum form of SEA in terms of integrating SEA into decision-making processes since it emphasises the following: an early start to SEA; the assessment of significance against objectives and baseline; the consideration of alternatives; and a strong emphasis on public participation. In terms of implementing CEA in the UK, this model would be most appropriate since it provides for a baseline and incorporates objectives as required under the SEA Directive.

7.6.2 SEA Procedures and methods

The planning and implementation of SEA involves the consideration of a number of issues. Since SEA and EIA processes are based on common principles, the SEA procedure has some similarities to the procedures in project level EIA (Lee and Walsh, 1992; Sadler and Verheem; 1996). In practice, however, procedures vary in terms of scope, detail and interrelationships of components due to the iterative character of the policy making process (Sadler and Verheem, 1996). Procedures are also likely to vary depending on the context for the SEA.

Partidario and Therivel (1996) outline a seven-stage SEA process consisting of: screening; scoping; impact identification and baseline studies; impact prediction; mitigation; review of SEA report and monitoring. These SEA process stages and its linkages with the PPP process are set out in Figure 7.1.

Figure 7.1 Links between PPP-making and SEA processes



Source: adapted from Partidario and Therivel, 1996

The above example shows a generic process and in practice a policy SEA would follow a different process from a plan SEA because the SEA has to be linked to the various

stages of the PPP process. Although the tasks might be slightly in a different order, these should focus on objectives and options (Sheate, 1996).

The SEA stages will be described in the following sections, including the methods used at each stage. Brown and Therivel (2000) suggested that there is no single SEA methodology[1] that can be applied to all the types of PPPs because of the range of SEA applications. Therefore, an appropriate SEA methodology will need to be designed according to the PPP formulation and decision-making context. Other factors which are likely to influence the nature of SEA methodologies are: the level at which PPP formulation and decision-making occurs; the time available for PPP development; the degree of public involvement; funding; and the complexity of issues examined (Brown and Therivel, 2000). But, there is a need for a consistent and structured methodology (Noble and Storey, 2001).

For each stage of the SEA process, particular methods or techniques are used. In terms of the range of methods and techniques used in SEA, these are drawn from two sources:

- Project EIA (e.g. checklists, matrices, network analysis and GIS)
- Policy analysis/ plan evaluation (e.g. scenarios, planning balance sheets, systems modelling, sensitivity analysis)

(Wood and Dejeddour, 1992; Sadler and Verheem, 1996)

Existing SEA methodologies tend to be based on project EIA principles and so methods for carrying out SEA need not be substantially different from project-level EIA (Sheate, 1996; Noble and Storey, 2001). SEA, however, requires a different, more broad-brush methodological framework to be effective (Noble and Storey, 2001). Therivel and Brown (1999) argued that although the philosophy of EIA can be transferred 'upstream' to PPPs, new methods designed specifically for SEA are required. In particular, methods are needed for considering indirect, secondary and cumulative impacts. Furthermore, SEA methods need to cope with greater uncertainty since effects of PPPs are often more uncertain than those of projects.

[1] Methodology is defined here as a framework or structure for organising a process (Noble and Storey, 2001)

Methods[2] and techniques[3] used in SEA fulfil two purposes: impact identification and impact analysis and prediction. Analytical methods that can be used in SEA to identify impacts include: scenario development, model mapping or networks and indicators. Methods for impact analysis and prediction include: networks; expert opinion; scenario analysis; computer modelling; GIS; life cycle analysis and multi-criteria analysis.

7.6.2.1 Screening

Screening determines whether to initiate SEA or exempt the proposals from further consideration. This may be to fulfil legislative requirements or to incorporate sustainability requirements into the PPP. Screening can establish the purpose for the SEA, the level of investigation required, at what stage the assessment should take place and the extent and type of involvement of other parties (Verheem and Sadler, 1996). Several methods can be used: checklists, case-by-case test for significance and screening questions.

7.6.2.2 Scoping

Scoping can be used to identify important issues (including cumulative effects) and determine the process for addressing them. It is probably the most crucial step in ensuring the SEA is feasible and useful (Therivel, 1996). Although the range of potential environmental impacts may be wide ranging, only a few of these will be important. Therefore, an 'objectives-led' approach in scoping can help focus the SEA (Sheate, 1996). Identifying the PPP's objectives and SEA topics, targets and indicators are the most important stage in SEA, which sets the framework for subsequent stages (Therivel and Brown, 1999). Consideration should also be given to the tier in the process at which the assessment is to be carried out since this will influence the types of alternatives and impacts to be investigated, the level of detail of the assessment and the methods to be used (Lee and Walsh, 1992). The decision about whom to involve in the SEA process is made at this stage. Scoping should be undertaken in consultation with other environmental authorities and the nature and extent of public participation will depend on the level of decision-making, who the 'public' are and the time scales involved (Sheate, 1996). Scoping therefore requires the consideration of the area boundary of the SEA, the spatial units over which impacts are addressed, the

[2] Methods – concerned with various aspects of the assessment (i.e., identification of likely impacts); a means of organising and evaluating data (GIS, network analysis)

[3] techniques in EIA/SEA are tools used for predicting future states of specific environmental parameters such as noise levels or Gaussian dispersion model and provide data for the assessment (Bisset, 1998; Noble and Storey, 2001)

identification of the relevant impacts to be addressed, and the identification and justification of the alternatives to be studied by the SEA. Methods used at this stage include: checklists, effects networks, public or expert consultations and surveys.

7.6.2.3 Establish baseline

As in project EIA, there is a need to establish the environmental baseline. In SEA, this will be of a more general nature (Sheate, 1996). The baseline study involves describing the action and its alternatives to allow the potential impacts to be identified and assessed (Lee and Walsh, 1992). The types of areas that are likely to be affected by the action should be identified and their environmental conditions described. Baseline descriptions should include predictions of future environmental conditions based on extrapolation of existing trends, development plans, policies and programmes. A range of future baseline conditions can be described using different scenarios.

Collecting and analysing baseline data for SEA can be difficult because it covers large areas and wide range of impacts (Therivel, 1996) or existing data may not be consistent or compatible. However, increasingly, there are databases that could be used (for example, the National Centre for Environmental Data in Bath holds national and regional datasets on topics such as pollution, water quality and abstractions, etc.; NetCen hold datasets on air quality). Also, local authorities are increasingly storing data in GIS. Relevant environmental information that could be used in establishing baseline conditions include: existing 'state of environment' reports; previous versions of PPPs; SEAs of higher or lower order PPPs and relevant project EIAs; environmental audits; environmental indicators and targets; and monitoring information on the area (Therivel and Brown, 1999). Indicators, which are tools for measuring and representing environmental trends, can be used to measure and describe baseline environmental conditions (Therivel, 1996). Techniques used to describe baselines include written descriptions, mapping and GIS.

7.6.2.4 Consider alternatives

This stage involves specifying, evaluating and comparing alternatives or policy options, including the case for continuing with the existing situation as well as the need for modification. The aim is to clarify the trade-offs at stake and point to the best practical environmental option. Evaluating alternatives is a critical element in facilitating informed choice (Sadler and Verheem, 1996). The starting point of the alternatives

analysis is the overall objectives of the PPP. Alternatives that will meet the objectives of the PPP should be identified, while taking account of limiting conditions and maintaining reasonableness and practicality (World Bank, 1996). In sectoral/regional SEA, the development objectives can be used for screening strategic development options. Providing opportunities for stakeholders to express their views during alternative analysis can be beneficial in terms of obtaining information and building consensus.

Alternatives can be developed using an 'optimisation' technique to group a subset of objectives (Sadler and Verheem, 1996). This requires identifying strategic options or scenarios, each of which encompasses a range of measures with different environmental, economic and social implications. Alternatives analysis could be used for distinguishing among alternative strategies and investment programmes within a sector (i.e. transport) and for reviewing sectoral policy changes. The most important purpose of area-wide SEA is to analyse the environmental implications of major alternative strategy options and to recommend a course of action or policies that will best achieve environmental sustainability (World Bank, 1996). Comparison of alternatives is particularly vital when a region is under environmental stress (Ibid, 1996).

Alternative options should be considered in terms of individual and cumulative impacts. Alternative mitigation options may also be included in the analysis. A matrix can summarise the specific and cumulative impacts of the plan but to identify and analyse cumulative impacts, network or systems diagrams would be more useful. Methods that can be used in evaluating alternatives are multi-criteria analysis to help define preferences and sensitivity analysis to examine the robustness of policy options.

Some problems in alternatives development in EIA that could also apply to SEA include: defining objectives narrowly as to limit and exclude reasonably competing alternatives; screening criteria and evaluation of alternatives lack rigor and documentation so that more environmentally sound alternatives can be eliminated; and environmental considerations and public input often occur too late in the process to shape the development of alternatives (Steinemann, 2001).

7.6.2.5 Predict impacts and evaluate significance

Impact prediction means determining the type and magnitude of impacts that the PPP is likely to have on the baseline environment (Therivel, 1996). In particular, the SEA should assess indirect and cumulative impacts, which are not adequately considered in project EIAs (Wood and Dejeddour, 1992; Therivel, 1996; Partidario, 1996; Stinchcombe and Gibson, 2001).

Impact prediction in SEA of policies and plans cannot be as detailed as in project EIA. In many cases, an indication of the type and level of future impacts may be all that is necessary (Therivel, 1996). Nevertheless, SEA should consider the whole range of impacts of a PPP, which include direct, indirect, positive, negative, short-term or long-term, induced and cumulative impacts.

A range of techniques can be used to predict impacts. Research and experience of SEA has shown that there is a lack of application of some of the more complex techniques. Qualitative techniques are likely to be used more often because of the broad nature of issues considered; the time lag between decision and implementation; greater uncertainty surrounding prediction of effect; lack of applicable baseline data and lack of resources for collecting comprehensive baseline data. However, where relevant data are available, it may be possible to employ quantitative prediction techniques (Therivel and Brown, 1999). For example, computer models are used to predict impacts (e.g. noise and air pollution) from transport.

Impact prediction in SEA can involve uncertainties due to the greater level of abstraction found in policies, plans and programmes and the cause-effect pathways of impacts being blurred (Sadler and Verheem, 1996). Uncertainties also cover issues such as the likely future of the state of the environment and the carrying capacities of environmental parameters to be determined (Therivel, 1996). However, Therivel (1996) suggested techniques for reducing uncertainty which include: stating predictions in terms of ranges rather than precise figures; basing predictions on different scenarios; using a precautionary approach and carrying out sensitivity analysis.

Evaluating impacts involves determining whether the likely future impacts of the PPP are acceptable, based on criteria such as regulations, guidelines, the PPP objectives, carrying capacity and public opinion (Therivel and Brown, 1999). Impact evaluation

also involves comparing alternatives, usually through expert judgement. However, quantitative methods could also be used such as: multi-criteria analysis, vulnerability assessment and economic valuation techniques (Sadler and Verheem, 1996).

7.6.2.6 Mitigation

Mitigation measures are ways to avoid, reduce or compensate for the impacts of the PPP. SEA allows consideration of a wide range of mitigation measures, especially measures to avoid impacts at an earlier, more appropriate stage of decision-making (Therivel, 1996). Mitigation at a strategic level can be more proactive and varied than those at the project level. It can include rewording of the PPP or parts of it, including its objectives; avoiding environmentally sensitive areas; suggesting amendments to other PPPs and suggesting requirements for subsequent EIAs (Therivel and Brown, 1999). Other examples include establishing management guidelines for the implementation of the PPP and monitoring programmes. A major advantage of mitigation in SEA is that it can address cumulative impacts better than at project level, particularly impacts from small developments. For example, the gradual loss of open spaces from housing can be addressed in land use allocations in plans.

7.6.2.7 Monitoring

The purpose of monitoring the PPP are: to test whether the PPP is achieving its objectives; to identify any negative impacts requiring remediation; to ensure that mitigation measures proposed in the SEA are implemented and to assist in predicting impacts in future SEAs (Therivel, 1996). Monitoring should refer back to the environmental baseline, predictions, mitigation measures, indicators and targets identified earlier. Monitoring is necessary in order to address cumulative impacts which can occur over time.

7.7 Application of SEA

The principles of SEA have been incorporated into existing legislation in many countries. For example, in the US, NEPA requires that EIA is applied to major Federal actions which include programmes, rules and regulations, plans, policies, procedures and legislative proposals (40 CFR 1508.18). The CEQ recommended that programmatic environmental impact statement (PEIS)s were prepared for federal actions that were related to each other geographically, generically (e.g. actions that have similarities) or related by stage of technological development (e.g. federally assisted

research). PEISs promote the consideration of cumulative environmental impacts that would otherwise be ignored in project EIAs (Sigal and Webb, 1989). Categories of PEISs prepared include flood control programmes, resource and waste management.

In Australia and New Zealand, there are some legal provisions relating to SEA within their EIA requirements (Wood, 1995). In New Zealand, the 1991 Resource Management Act requires SEA of certain regional and local policies and plans. The Act's planning structure provides for a tiered approach in environmental assessment. But there have been some variations in the quality of policy statements and plans (Bailey and Dixon, 1999). In Australia, there is general support among EIA authorities for Cumulative Impact Assessment (CIA) and SEA but there is no evidence of their application on a comprehensive basis (Court *et al*, 1994).

In Canada, a non-legislative SEA process was introduced in 1990 at the federal level which required all federal departments and agencies to assess the environmental effects of policy, plan and programme proposals submitted for cabinet consideration. This was updated in 1999 through the Cabinet Directive on the Environmental Assessment of Policy, Plan and Programme Proposals to strengthen the role of EA at the strategic level (CEAA, 1999). In the EU, forms of SEA are being applied at the plan and policy levels (Sheate et al, 2003). In the Netherlands, for example, the EIA system was designed to encompass SEA, relating to structure plans for utilities, to provincial waste management proposals, mineral extraction plans and certain types of land use plans (Verheem, 1992).

In the UK, policy appraisals, environmental and sustainability appraisals have been put forward as a form of SEA (see section 5.5.3). This objectives-led appraisal approach has been increasingly adopted at strategic decision-making levels because it can be done relatively simply without the need for extensive baseline data and it relates more easily to the policy-making process (Therivel and Minas, 2002). But such appraisals have limitations. They are *"often vague, poorly informed and largely aspirational, with targets consequently more arbitrary than robust"* (Sheate, 2002, p.v). They are not, however, SEA because although it takes account of the impacts of a policy or proposal, it does not result in a modification of the proposal (Sheate, 1996). There are, however, some SEAs undertaken in the UK. For example, the Strategic Environmental Appraisal (MOD, 2000) of the Strategic Defence Review considered the impacts of 454

programmes and plans. In the SEA, cumulative effects were assessed in terms of the various receptors and resources.

Overall, the practice of SEA is increasing and there are good practice examples of SEA (Glasson, 1995; Partidario and Clarke, 2000; Sheate et al, 2003). SEA practice, as with planning in general, is moving from a rationalist decision making approach to one which reflects "collaborative consensus-making" approaches to land-use planning (Therivel and Partidario, 2000). SEA as normally practiced, is used to refine strategic actions and mitigate negative environmental consequences. However, it has the potential to be a much stronger tool for sustainability by incorporating sustainability targets or carrying capacities into strategic actions (Therivel and Partidario, 2000). Several sets of criteria have been developed to consider SEA effectiveness in terms of: substantive and procedural dimensions (Sadler, 1996), contextual issues (Marsden, 1998) and inputs, process, content, results and effects of activity (Thissen, 2000). But to a certain extent, what is effective SEA will depend on the specific context in which it is applied (Therivel and Partidario, 2000). Effective SEA is linked to: starting early, involving a range of disciplines and the public, a transparent process, focusing on enhancement rather than mitigation, resources available and documentation of the process (Therivel and Partidario, 2000; Therivel and Minas, 2002). Equally important is that for SEA to be effective, it should address cumulative effects.

7.8 Assessing cumulative effects in SEA

Sadler (1996) suggested ways of extending SEA as a tool of impact analysis and sustainability, which includes the application of SEA to address cumulative effects. In SEA, a qualitative analysis and preliminary identification of possible types of cumulative effects can be given. This can then assist plan-making and project level assessments as well as indicate further requirements for monitoring.

Frameworks and approaches for analysing cumulative effects (see Chapters 3 and 4) can be used in SEA. These approaches define cause-effect relationships which consist of the following components:

- sources – the pattern and timing of activities that cause or can initiate environmental change;
- processes – the pathways, mechanisms and triggers that result in accumulation of effects

- effects – the impacts and long term changes that occur in response to perturbation and stress.

Sadler (1996) suggested that these elements provide an appropriate focus for SEA to address cumulative effects:

- sectoral or programmatic level SEAs can focus on sources or activities that lead to cumulative effects. For example, road and transport strategies;
- regional plans can concentrate on the effects and the sensitivities and capacities of the receiving environment, such as the cumulative effects of development on watersheds, wetlands and open spaces.
- policy appraisals can benefit from taking a synoptic, process perspective of relationships and consequences. They can be useful in identifying the wider implications of economic initiatives.

In policies, plans or programmes, cumulative effects can be considered in terms of:

- accumulation of the same impact from a number of similar projects in a region, for example, water pollution from mining projects or air pollution from waste incinerators;
- accumulation of different impacts from a number of projects – combined impacts such as noise, dust and air pollution from construction developments in a neighbourhood.
- accumulation over time – build up of toxic contaminants in an ecosystem.

(adapted from Sadler, 1996)

There are existing methods that can be adapted to analyse cumulative effects. The most commonly used are the expanding matrix methods and network analysis (Sadler, 1996). To be effective, these methods should express source-effect linkages based on a limited number of elements, which should then be related to the policy and institutional sources of the problem.

7.9 The EU SEA Directive

Environmental and sustainability appraisals have been carried out in the UK for over a decade. However, it is likely that this system will change as the European Directive 2001/42/EC becomes operational. The objective of the SEA Directive is *'to provide for a high level of protection of the environment and to contribute to the integration of*

environmental considerations into the preparation and adoption of plans... with a view to promoting sustainable development" (Article 1). The Directive defines 'environmental assessment' as a procedure consisting of:

- preparing an environmental report on the likely significant effects of the plan or programme;
- carrying out of consultations on the plan or programme and the environmental report;
- taking into account the environmental report and the results of consultations in decision-making; and
- providing information on how the results of the SEA has been taken into account. (Article 2 (b))

7.9.1 Scope

The Directive specifies the scope to which the Directive will apply, which are plans and programmes, which are likely to have significant effects (Article 3). While the Directive applies only to plans and programmes, it is expected to bring more attention to the higher policy level decision-making since decisions made at this level may be subject a closer examination through the SEA of plans and programmes (Sheate, 2003). The Directive indicates the types of plans and programmes it could apply to in Article 3 (2) to (4).

Article 3 (2) requires that an environmental assessment be carried out for all plans and programmes:

(a) prepared for agriculture, forestry, fisheries, energy, industry, transport, waste management, water management, telecommunications, tourism, town and country planning or land use and which set the framework for future development consent of projects listed in Annexes I and II to Directive 85/337/EEC, or

(b) which, in view of the likely effects on sites have been determined to require an assessment pursuant to Article 6 or 7 of Directive 92/43/EEC.

The SEA Directive will therefore apply to plans and programmes that are prepared for the sectors specified in Article 3 (2) and those that set a framework for the future development consent of projects requiring environmental assessment under the EIA

Directive. Furthermore, SEA will need to be undertaken for plans and programmes that may have an effect on wildlife sites, which the Habitats Directive determined requires an assessment.

Article 3(3) and 3(4) specifies those plans and programmes for which SEA is not always required:

- plans and programmes referred to in Article 3(2) which determine the use of small areas at local level;
- minor modifications to plans and programmes referred to in Article 3(2);
- plans and programmes other than those referred to in Article 3(2) which set the framework for future development consents of projects.

The expressions 'small area' and 'minor modifications' are not defined in the Directive and should be interpreted in the context of the particular plan. Screening is required in order to determine whether such plans or programmes are likely to have significant effects. Article 3(5) stipulates that Member States can determine whether plans and programmes are likely to have significant effects either through case-by-case specification or specifying certain types of plans or programmes or by combining both approaches. Whichever approach is taken, Member States should take into account the criteria for determining significance outlined in Annex II of the Directive. These criteria consist of two elements: i) the characteristics of plans and programmes and ii) characteristics of the effects and of the area likely to be affected. Among the likely effects is the '*cumulative nature of the effects*'. In determining the types of plans to require an SEA, Member States should therefore take account of cumulative effects.

In the UK, the list of plans and programmes to which the SEA directive will apply still has to be determined[4]. However, it may apply to a wide range of plans and programmes, such as those prepared by Government Departments or Non-Departmental Public Bodies which prepares plans for the sectors mentioned in Article 3(2) of the Directive, including those for town and country planning and land use. It will apply to both the present system of local authority development plans and Regional Planning Guidance and the proposed Local Development Documents and Regional Spatial

[4] The Draft Environmental Assessment of Plans and Programmes Regulations 2004, A Consultation Document (ODPM, 2004) was issued on February 2004.

Strategies as well as other plans prepared by local authorities such as Minerals Local Plans and Waste Local Plans (ODPM, 2004).

The Directive applies to plans and programmes and modifications to them, whose formal preparation begins after 21 July 2004. It will also apply to plans and programmes whose formal preparation began before that date, if they have not been adopted by 21 July 2006.

7.9.2 Requirements of the Directive

The SEA Directive sets out a procedure which requires the following:

- collecting and presenting baseline environmental information;
- predicting the significant environmental effects of the plan or programme and addressing them during its preparation;
- identifying strategic alternatives and their effects;
- consulting the public and authorities with environmental responsibilities;
- monitoring the actual environmental effects of the plan or programme during its implementation.

The stages of the SEA are shown in Figure 7.2. The Directive requires consultation at two stages:

- Scoping: Decision on the scope and level of detail of the SEA – the planning authority must consult with "other authorities ...which, by reason of their environmental responsibilities likely to be concerned by the environmental effects [of the plan or programme] (Article 5(4)). For England, these include the Environment Agency, Countryside Agency, English Nature and English Heritage.
- Environmental report and proposed plan:
  - The proposed plan should be made available to authorities with environmental responsibilities and the public (Article 6(2)).
  - The planning authority must consult "the public affected or likely to be affected or having an interest" and the authorities with environmental responsibilities on the proposed plan or programme and the Environmental Report (Article 6(2)).

Planning authorities already consult these authorities and other bodies under existing arrangements. However, a new requirement is to make the Environmental Report available.

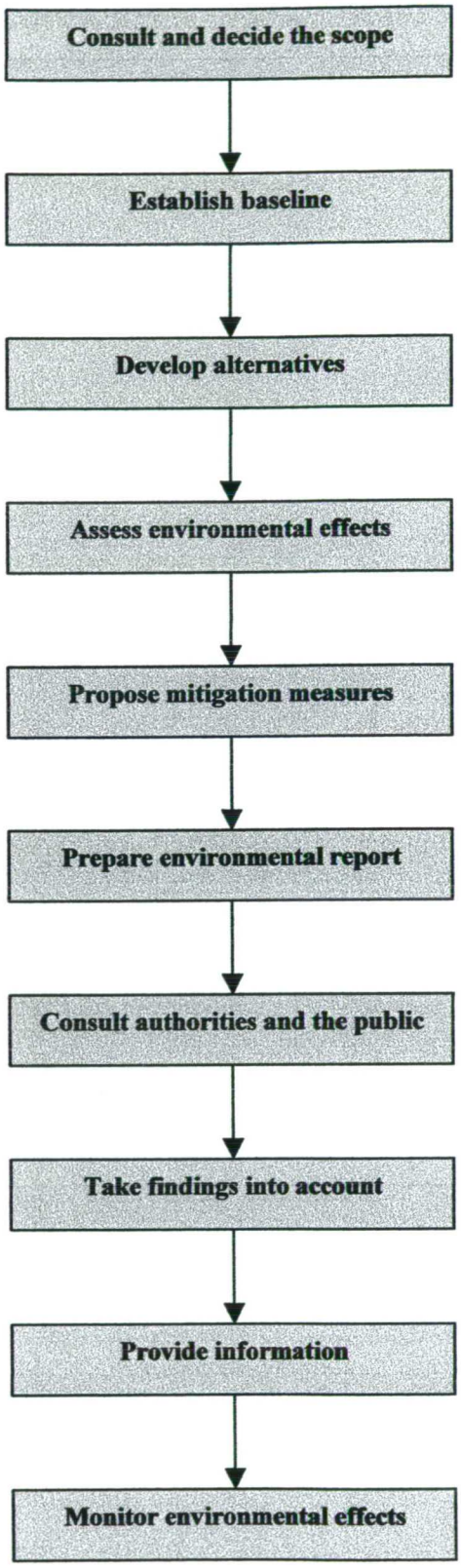
The Directive does not specify who should undertake the SEA, which is usually the responsibility of the planning authority. It would be helpful to involve those producing the plan and others who are within the authority or those from outside who can provide a more detached and independent view on the assessment.

With respect to cumulative effects, these are referred to in Annex 1 and II:

- The information to be provided in the environmental report should include "*the likely significant effects [including secondary, **cumulative, synergistic**, short, medium, and long-term permanent and temporary, positive and negative effects] on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationships between the above factors*" (Annex 1,f).

- The criteria for determining the likely significance of effects include the characteristics of the effects and of the area to be affected. Under this, there are several elements to consider which include *the cumulative nature of the effects*.

Figure 7.2 Procedure outlined in the SEA Directive



Consult authorities with environmental responsibilities and decide on the scope and level of detail of the information to be included in the environmental report (Article 5(4)).

The environmental report should include relevant aspects of the state of the environment, characteristics of areas to be affected and existing environmental problems relevant to the plan or programme (Annex 1)

The environmental report should identify, describe and evaluate reasonable alternatives, taking account the objectives and the geographical scope of the plan or programme (Article 5(1)).

The likely significant effects [secondary, cumulative, synergistic, short, medium and long term, positive and negative effects] on the environment and on other issues [biodiversity, population, etc] and the interrelationships among those factors should be assessed (Annex 1).

Propose measures to prevent, reduce and offset any significant adverse effects on the environment resulting from the implementation of the plan or programme (Annex 1).

An environmental report should be prepared taking into account current knowledge and methods, the contents and detail of the plan and the stage in the decision-making process and the extent to which certain matters are appropriately assessed at different levels in that process (Article 5(1) and 5(2)).

The authorities with environmental responsibilities and the public should be given an early and effective opportunity to give their opinion on the draft plan or programme (Article 6 (2)).

The environmental report and the findings of the consultations should be taken into account in the preparation of the plan or programme before its adoption (Article 8).

The consultees (environmental authorities and the public) should be provided information on how environmental considerations have been integrated into the plan or programme; how the environmental report and consultees' opinions were taken into account and monitoring measures Article 9).

During implementation of the plan or programme, significant environmental effects should be monitored in order to identify unforeseen adverse effects and undertake remedial action (Article 10).

7.10 Changes in the planning process in order to satisfy the requirements of the SEA Directive

In order to comply with the SEA Directive, the planning and appraisal process will need to be modified in terms of: consultations; provision of baseline information; its use of the appraisal; and publishing information on the changes as a result of the appraisal. In terms of consultations, the SEA Directive specifies that consultations should be undertaken during two stages:

1) During the plan preparation, planning authorities are required to consult with environmental authorities during plan preparation. The ODPM plan-making guide (2002 p. 63) suggests seeking participation from all sections of the community at the outset of the process. This means engaging with key stakeholders through community and local forums complemented by work providing information to the wider public. The ODPM guide does not specify who the consultees from other authorities should be, although under current planning processes, planning authorities already consult with other authorities with environmental responsibilities and other bodies when preparing plans.

2) After the plan and environmental report has been prepared. Planning authorities are required to consult with those who are likely to be affected and authorities with environmental responsibilities on the draft plan and the environmental report. Under the ODPM Guide (2002, p.87) planning proposals are examined through consultation and, under current arrangements, the local inquiry leading to modifications and eventual adoption. However, a new requirement in the SEA Directive is that the Environmental Report is made available to the public and environmental authorities and publishing the changes in the appraisal as a result of consultations.

Another change to the planning process as a result of the SEA Directive relates to the provision of baseline information on the environmental report and information on how the environmental considerations and consultations were taken into account. The Directive specifies the information to be included in the environmental report in Annex 1(b,c,d): relevant aspects of the current state of the environment; environmental characteristics of areas to be significantly affected and any existing problems, especially those relating to areas of particular environmental importance. Although the publication

of adopted plans is long established in planning practice, in order to comply with the Directive, authorities will need to make clear how they have taken the findings of the SEA into account. This information should include:

- any changes or deletions to the plan in response to the information in the Environmental Report;
- how the responses to the consultations have been taken into account;
- monitoring measures.

A major change, however, relates to how the plan should be assessed. Under current practice, sustainability appraisal adopts an objectives-led approach where impacts are assessed against sustainability objectives while SEA requires that these impacts should be assessed against a baseline. There are, therefore, fundamental differences in these approaches. Furthermore, the Directive requires that the likely ***cumulative and synergistic*** effects of a plan should be assessed. The assessment of cumulative effects requires that the baseline and trends for selected resources are established and the effects are assessed against this baseline. Sustainability appraisal, which is based on objectives with no detailed baseline does not really allow for this. In order to fulfil the requirements of the Directive regarding cumulative effects, the current approach and procedures for assessing plans may need to be significantly modified.

7.11 Summary

This Chapter discussed SEA as a context for CEA and discusses the implications of implementing the SEA Directive on the appraisal and planning practice in the UK. The next chapter, Chapter 8 establishes the context for cumulative impacts by focusing on a particular sector, urban regeneration.

Chapter 8 Considering cumulative effects in planning for sustainable urban regeneration

8.1 Introduction

Cumulative effects can result when multiple developments occur concurrently or sequentially within a defined geographical area (space crowding and time crowding). This type of cumulative effects is the focus of this research and urban regeneration strategies have been selected as the unit of analysis.

The research project focused on urban regeneration since it illustrates cumulative effects well and also there are few studies in this area relating to environmental impacts. As far as cumulative effects are concerned, these have focused largely on wetlands, parks and natural areas rather than urban ones. Furthermore, there are many urban areas in the UK undergoing urban regeneration so any findings on cumulative effects may be useful in assessing the environmental effects of an urban regeneration policy, plan or proposal.

This chapter presents an overview of urban regeneration policy for areas where development and change are considered essential. Urban and regional policy has traditionally been considered in terms of public investment and subsidy (Rydin, 1998a). The market-oriented approach in the 1980s still continues today so that the environmental implications of these schemes are not often addressed.

Potential cumulative effects in urban regeneration strategies are presented. The implementation of urban regeneration policy in the case study for this research, the Thames Gateway, is described and the opportunities for addressing cumulative effects are explored.

8.2 Urban regeneration: definition and purpose

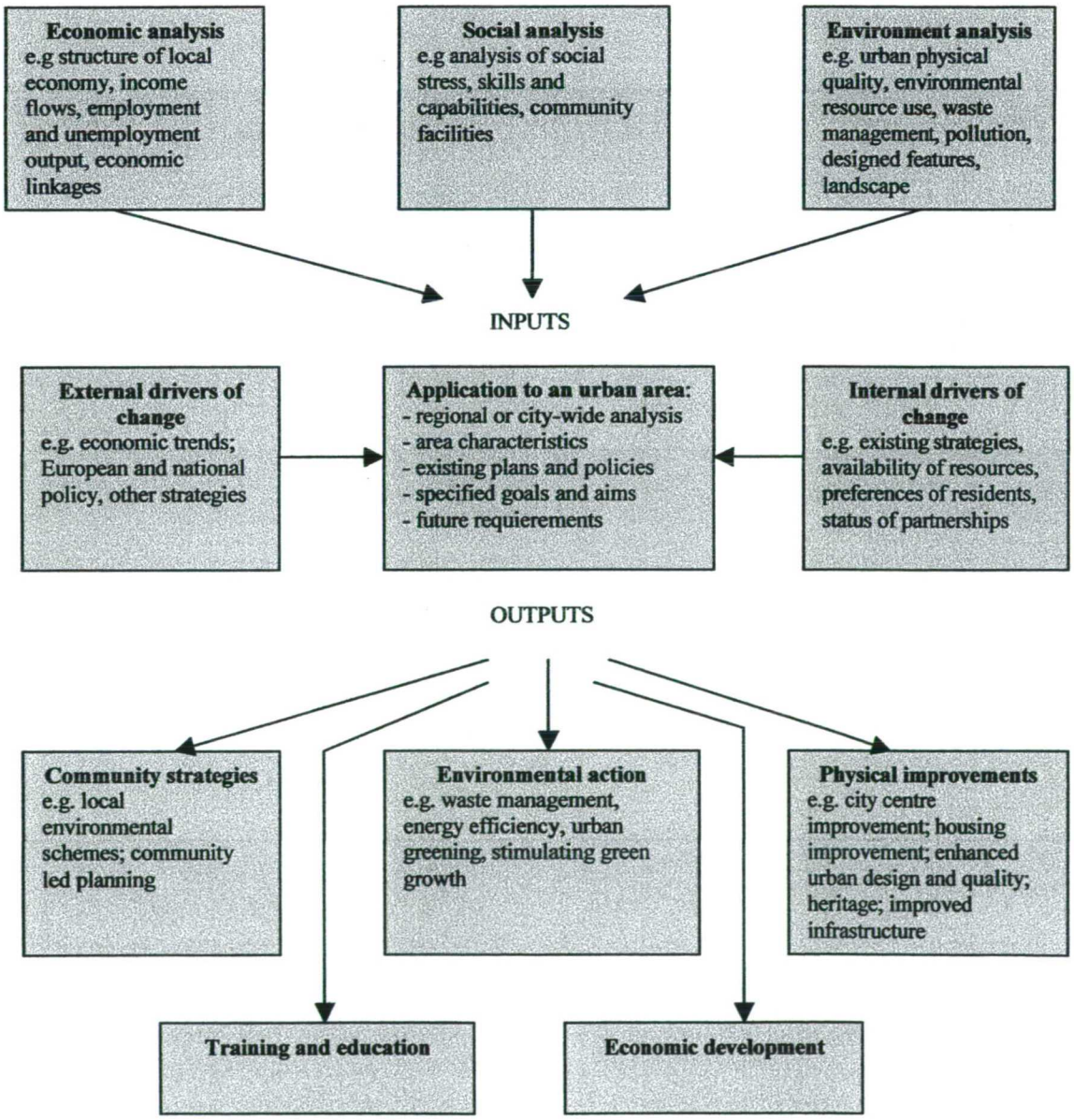
Urban regeneration is defined as a *"comprehensive and integrated vision and action which leads to the resolution of urban problems and which seeks to bring about lasting improvement in the economic, physical, social and environmental conditions of an area that has been subject to change"* (Roberts, 2000).

The essential elements of urban regeneration include the need for a better understanding of the processes of change, a strategic framework and a co-ordinated and integrated

effort. It goes beyond urban renewal, which is essentially a physical process of urban change (Couch, 1990).

Urban regeneration can be seen as a means of determining policies and actions designed to improve the condition of urban areas and developing the institutional structures necessary to implement specific proposals (Roberts, 2000). It relates to the functioning of the urban system as a whole and to the operation of the economic, social, physical and environmental processes that determine the content of urban regeneration. It is a strategic process within which specific plans and projects can be designed and implemented. The urban regeneration process is shown in Figure 8.1.

Figure 8.1 The Urban Regeneration Process (adapted from Roberts, 2000)



8.3 Urban regeneration policy and implementation

8.3.1 Regeneration policy

Regeneration is a major component of urban policy in the UK and is currently referred to in ten separate Planning Policy Guidance notes. Although urban regeneration has social and economic dimensions, this research is mainly concerned with environmental implications. Urban regeneration initiatives usually include elements of environmental improvements but it generally involves construction of multiple developments and infrastructure with potential for environmental impacts.

Regeneration policy has been implemented through: grants for physical improvements; land transfers; and promotion of regeneration through partnerships (Rydin, 1998a). Grants for physical improvements, such as improvement or reclamation of derelict land are managed by Local Authorities, English Partnerships or Regional Development Agencies (RDAs). Regeneration has been funded through the following programmes: the City Grant, Urban Development Corporations, City Challenge, the Single Regeneration Budget and English Partnership's Investment Fund.

A property-led regeneration is one in which public land is transferred to public corporations, such as urban development corporations (UDCs). These UDCs have powers of land assembly, development control, reclamation, development and disposal to developers. Although UDCs do not have formal development planning powers, their development plans are effectively local plans. But such schemes are corporate planning documents and are not open to public consultation and scrutiny in the same way as a development plan (Rydin, 1998a). The UDC submits proposals direct to the Secretary of State for development of land in its area and after consultation with local authorities, may approve the proposals with or without modifications.

There were 13 UDCs designated from 1981- 1998, which included the London Docklands Development Corporation (LDDC). These UDCs have a limited life and the remaining ones were transferred to the Commission of New Towns. The initial remit of the UDCs was to focus on physical development but this was widened to include social regeneration and community development objectives (Wilks-Hegg, 2000). But these UDCs, although successful in facilitating development, were divorced form local communities (Rydin, 1998a). The LDDC, for example was criticised for ignoring the social and community aspects of regeneration (Wilks-Hegg, 2000).

Since the 1990s, there has been a consensus that successful urban regeneration requires a strategically designed, locally based, multi-sector, multi-agency partnership approach. In many ways urban and regional policy represent the new politics of governance where its defining feature is the close relationships between state organisations, quasi-state organisations (quangos) and outside bodies (Rydin, 1998a). But the effectiveness of partnership and the outcome of regeneration require a sound national urban policy and a coherent land use or regional development framework (Carley et al, 2000).

8.3.2 Regeneration initiatives

Since 1997, the Government has embarked on a new phase of regeneration policy, locating regeneration efforts within a regional framework and promoting community involvement and community-led regeneration initiatives. To reinforce these changes, the Government created RDAs and introduced area-based initiatives. RDAs have been given responsibility for social, physical and economic regeneration. However, the RDAs' main preoccupations are with economic strategies (Robson et al, 2000).

The Local Government Association's New Commitment to Regeneration (NCR) is based on the preparation of comprehensive, bottom-up regeneration strategies at the level of a local authority or in some cases, a group of authorities. These strategies are concerned with the broad agenda of social, economic and environmental regeneration. The NCR has the potential to provide a link in the development of approaches to regeneration by connecting neighbourhood regeneration strategies to the emerging integrated regional strategies being prepared by RDAs (Wilks-Heeg, 2000).

Overall, the contribution of urban regeneration in the urban policy arena is in developing partnerships and providing a strategic approach to urban problems (Roberts and Sykes, 2000). It provides a framework that can be used to guide associated plans of action with potential to ensure efficient use of resources and can be an important means for the generation and implementation of sustainability policies.

8.4. Environmental considerations in regeneration

There has been a shift in environmental considerations from the notion of environmental improvements during previous decades to broader ideas of environmental sustainability in the 1990s, which continue until today (Roberts, 2000). This focus on sustainable development will have significant implications for

infrastructure provision in urban regeneration, particularly transport. For example, there are moves to restrict the use of the private car in urban areas and encourage use of public transport. The promotion of regeneration in urban areas has been influenced by the 'greening' of planning so that some local authorities have sought to promote development, which are more sustainable environmentally (Gibbs, 1994). The Sustainable Communities Plan is also likely to influence regeneration efforts by Local Authorities. For example, in the London Borough of Greenwich, the Council promotes sustainable use of resources and monitors energy use and waste management in new developments. It is worth noting that regeneration policies and proposals are a major component in development plans, particularly in UDPs.

The importance of urban regeneration's contribution towards a sustainable pattern of development through the use of previously developed land is recognised in *Sustainable Development: the UK Strategy* (HMG, 1994) and in *A better quality of life: a strategy for sustainable development for the UK* (DETR, 1999b). According to these government strategies, sustainable development requires that decisions take proper regard of environmental impact in terms of minimising environmental pollution and conserving natural resources. However, there has been little co-ordination between urban regeneration and sustainable development and the emphasis of urban regeneration has been on economic regeneration (Couch and Dennemann, 2000). For example, an evaluation of English Partnerships, the Government agency created in 1993 to facilitate regeneration, notes that the "*staff are sometimes unsure as to what factors to address when assessing the environmental impacts of projects*" (PA Consulting Group, 1999).

To support their urban regeneration policy, the Government commissioned the report "*Towards an Urban Renaissance*" (Urban Task Force, 1999) and its recommendations were incorporated in the Urban White Paper "*Our Towns and Cities: the Future*" (ODPM, 2000). These documents recommended that strategic partnerships should be the implementing mechanism for urban regeneration plans or programmes which will address economic, social and environmental issues. The Urban Task Force report identified key elements necessary for an urban renaissance: social inclusion, sustainable development and urban regeneration. The Urban White Paper proposed to implement the Government's regeneration policy through the following mechanisms:

- Regional Development Agencies (RDAs) which take a lead in determining the strategic regeneration of urban areas at regional level. The RDAs are involved

in housing-led regeneration projects, particularly in resourcing site preparation, which is important in terms of the government's policy to prioritise urban brownfield sites for housing.

- Local authorities, which have a statutory duty to promote the economic, social and physical welfare in their areas, play a strategic role alongside local and regional partners in determining priorities for regeneration.
- Urban Regeneration Companies to co-ordinate and deliver area regeneration plans.

The Urban Task Force report (1999) recommended that regional planning should provide an integrated spatial framework for planning and transport policies; steer developments towards more effective use of urban land and buildings accessible by sustainable forms of transport; and encourage the use of sub-regional plans to set overall requirements for providing housing on brownfield land.

However, it should be noted that the thrust of this report is that regeneration has to be design-led so that the main focus is on urban design. The report made some suggestions made to LPAs relating to the environment:

i) to carry out regular capacity studies;
ii) protect and designate green spaces and retain general presumption against development on Green Belt;
iii) regulate environmental protection in respect of contaminated sites
iv) wider environmental impacts of development which are not currently taken into account within the existing system of planning obligations and planning gain should be addressed through impact fees.

The wider impacts referred above are also cumulative effects issues: increased air pollution by increased road traffic use; increases in energy consumption and green house gas emissions; loss of countryside and landscape; damage to biodiversity; impacts on historic and cultural resources; soil erosion and loss; pressures on waste and water management systems (Urban Task Force, 1999). Unfortunately, the Task Force recommendation in tackling development in greenfields and wider environmental impacts was limited to the application of economic instruments: greenfield tax and impact fees.

The Urban White Paper (2000) has taken forward most of the Urban Task Force recommendations including those relating to increase in housing density, mixture of land uses, the use of previously developed sites, and giving priority to public transport needs of regeneration areas. These urban policies are likely to affect the types and features of regeneration schemes to be proposed and the potential environmental effects of future developments.

8.5 Environmental impacts of urban regeneration

Environmental impacts resulting from urban regeneration relate to the types of developments, scale, timing, geographical location and environmental setting. Most of these effects are urban-related. For example, the interim evaluation of the Greenwich Peninsula Developments (a catalyst for the regeneration in Greenwich and the Thames Gateway) showed that the residents and the businesses were concerned about the effects of the developments on traffic congestion, air and noise pollution (SQW, 2000).

Currently, the environmental impacts of urban regeneration developments can be assessed through project EIAs. Urban regeneration projects are covered under Urban Developments in Schedule 2 of the Town and Country Planning (Environmental Impact) Regulations 1999 (No. 293). However, as discussed earlier (see section 4.5.2) project EIAs generally do not address cumulative effects adequately.

Potential cumulative impacts can occur from urban regeneration developments through space and time crowding since these developments are implemented within a specific geographical area and time period. These effects include traffic congestion, noise, deterioration of air quality and loss of habitats. But there could also be positive impacts, such as better visual quality and re-use of derelict land.

A feature of regeneration policy is the use of brownfield sites to accommodate new development, which can have positive and negative impacts. On the positive side, it protects green spaces and the countryside, improves the visual impact of derelict sites and releases sites for housing and other uses but on the negative side, it means increase in impacts (traffic congestion, loss of open space) in urban areas where most of these sites are located. Some examples are listed in Table 8.1.

Table 8.1 Potential cumulative effects from urban regeneration

Negative impacts	Positive impacts
Increase in traffic volumes from new developments	Better designed urban spaces
Deterioration of urban air quality from increase in car use and slow moving traffic	Positive visual impacts from new developments as opposed to derelict sites
Habitat loss and fragmentation through development of land	Environmental improvements and enhancement measures
Loss of soil quality and quantity	Planned developments
Reduction of groundwater supplies and potential for groundwater contamination from surface run-off	Promotion of public transport could lead to improvements in provision of facilities
Increased sediment, chemical and thermal loading of freshwater and marine habitats resulting from built development activities	Introduction of energy saving, water re-use, waste management schemes in construction of new housing
Increase in production of waste	Remediation of contaminated sites
Increase in energy consumption	
Change in landscape character	
Loss of open space	
Construction impacts: noise, dust, traffic	

Positive impacts can result from the implementation of local authority policies and use of sustainability tools. But, in a study of urban regeneration in the London Borough of Southwark, Rydin *et al* (2003) examined sustainability tools such as environmental assessment, sustainability audits and sustainability indicators and found that local political circumstances were the key factors in shaping policy practice and outcomes.

One problem with most urban regeneration schemes is the emphasis on master plans and design. In order that the wider effects might be addressed, urban regeneration needs to be considered at strategic or higher planning levels, as in area or even regional assessments. These assessments need to cast a wider net, both spatially and temporally, in order to minimise the possibility of overlooking major impacts and thereby consider cumulative upstream and downstream impacts (World Bank, 1997). To explore the environmental impacts associated with urban regeneration and the mechanisms for addressing them, this researched focused on one large case study, the Thames Gateway.

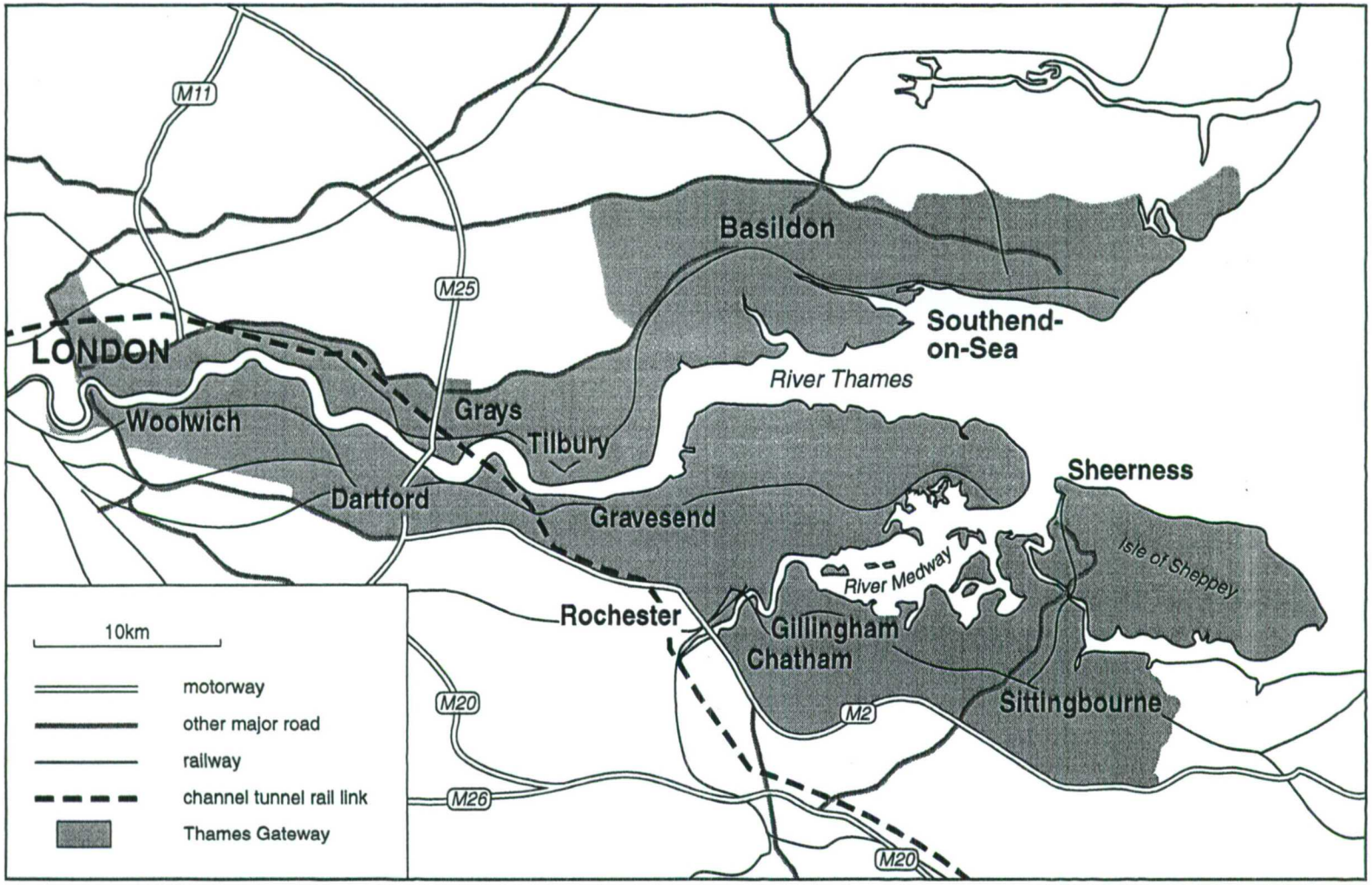
8.6 The Case Study: Urban regeneration in the Thames Gateway

8.6.1 The Thames Gateway area

The 'Thames Gateway' is the largest urban development scheme in the UK and the regeneration of the area is a regional and national priority. The area extends for 40 miles along the lower Thames from the Docklands in London to the Isle of Sheppey in Kent and Southend on Sea in Essex. The extensive areas of derelict land, the availability of surplus labour, its proximity to central London and continental Europe, access to air transport and the prospect of high speed international and domestic rail services on the Channel Tunnel Rail Link are some of the factors which contribute to its potential for growth (RPG 9a, 1995). A map of the Thames Gateway is shown in Map 8.1.

The Thames Gateway area covers 4000 hectares. Within London, the area covers a strip along both sides of the River Thames, eastwards from Deptford and the Royal Docks and extending northwards to the Lea Valley to include Stratford. The A13 defines the northern boundary. South of the River Thames, Thames Gateway includes Greenwich, Woolwich and the southern boundary runs along the A207. In Kent, the area extends to the A2/M2 boundary and includes Dartford, Gravesend, the Medway and Sittingbourne. In Essex, Thames Gateway originally included parts of Thurrock and Purfleet, Tilbury and Grays. In 2001, the boundary was extended to cover more of Thurrock, part of Basildon district, the boroughs of Castle Point and Southend on Sea and Southend Airport in Rockdale District (GOSE, 2001). The Thames Gateway covers parts of three regions: Southeast, East of England and London.

Thames Gateway was formerly known as East Thames Corridor. It was originally a collection of substantial and disparate development sites, characterised by industrial dereliction and environmental damage (RPG 9a, 1995). The origin of the initiatives to develop the area goes back to the 1980s, as some local authorities tried to address the problems of industrial dereliction and rising unemployment (Llewelyn Davies et al, 1993). The potential of the Corridor as a growth area has been recognised in studies undertaken by the London and Southeast Regional Planning Conference (SERPLAN, 1987; SERPLAN, 1988; SERPLAN, 1990). The Regional Planning Guidance for the South East (RPGSE, 1994) identified the Thames Gateway as one of the main growth areas in the area. This vision was reinforced in subsequent RPGs [Southeast (RPG 9, 2001), East of England (draft RPG 14, 2004) and the London Plan (GLA, 2004)] and the Sustainable Communities Plan (ODPM, 2003).



Map 8.1 Thames Gateway

Source: DTLR (2001)

8.6.2 Guidance

The *Thames Gateway Planning Framework* (RPG 9a) sets out Government policies to guide its future planning. Its aim is to foster sustainable patterns of development as outlined in *Sustainable Development: the UK strategy* and that development *'should have proper regard for environmental impact'* (RPG 9a, 1995). It provided the context for the revision of statutory development plans produced by local authorities. The Planning Framework identified the following environmental objectives: the protection of the main environmental features of the area and an overall improvement of environmental quality (RPG 9a, 1995).

It defined five principles to guide land use planning:

- the number, scale and potential quality of many of the development sites provide a significant resource for regeneration and their strategic importance recognised;
- plan for the right mix of development on the major sites to create a sustainable pattern of communities;
- consider proposals for transport and developments together;
- take account of the economic and environmental potential of the river and waterfront;
- adopt a new approach of greater care for the environment and create a new environmental standard in the quality of the built environment

In 2001, the revised RPG for the South East (RPG 9) recommended that there should be a new strategic partnership to co-ordinate the efforts and programmes of the various organisations involved. Other relevant guidance for Thames Gateway include RPG 3 (*Strategic Guidance for London, 1996*) which contain strategic planning guidance for the River Thames, draft RPG 14 and the London Plan.

8.6.3 The Strategy

The *Thames Gateway Planning Framework* (RPG 9a) envisioned two main centres of development: the Royals and Stratford and Kent Thames-side. It foresaw the following growth sectors: distribution/ logistics, ports, leisure, environmental technology, tertiary education and health, as identified in the capacity and development potential study conducted by Llewelyn Davies et al (1993). The strategy was indicative rather than prescriptive. The flagship developments in the Gateway are: the Greenwich Millenium

Village and the Dome; the Royal Docks; Rochester Riverside; North Dartford and the Royal Arsenal in Woolwich.

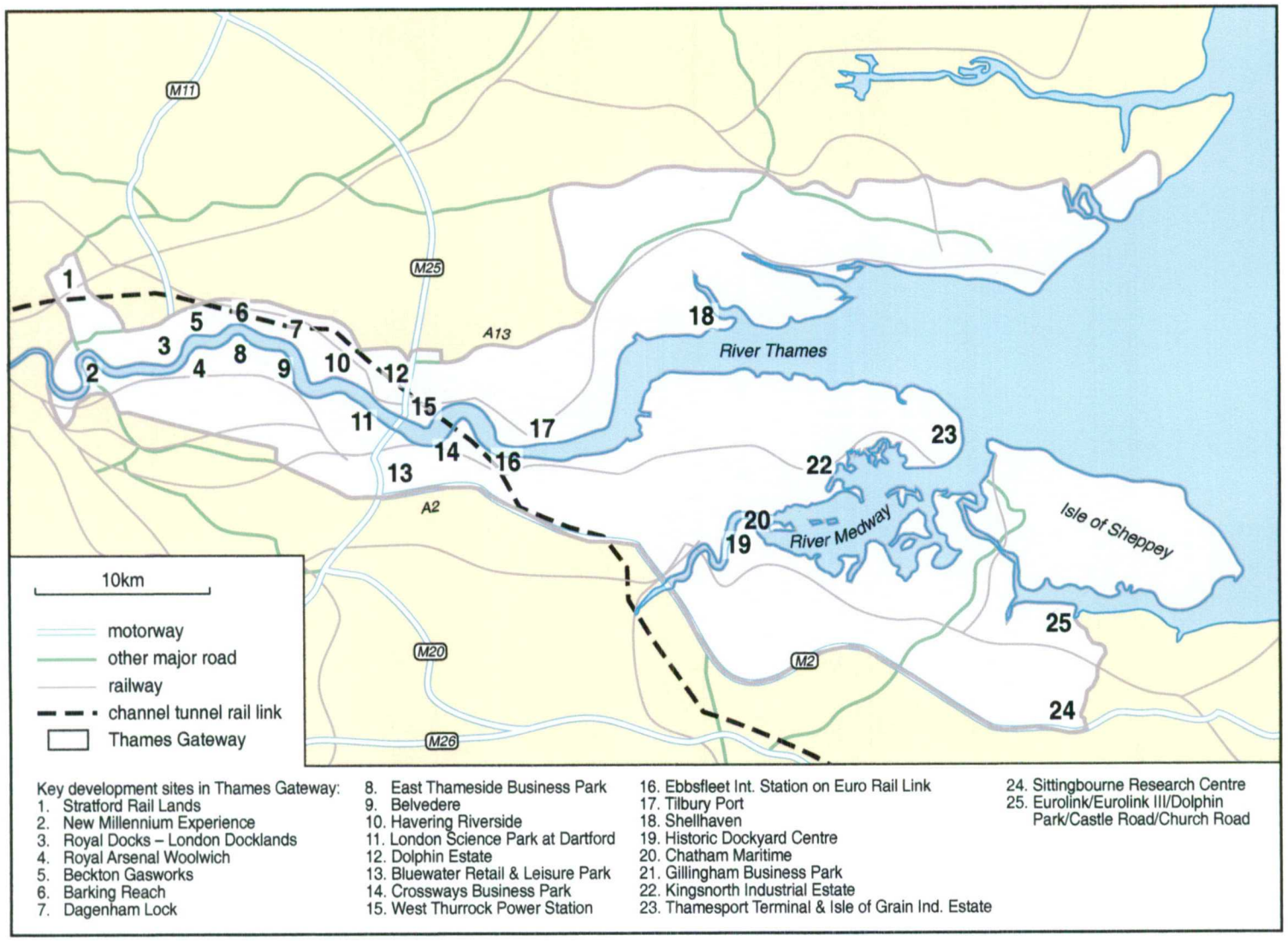
As far as housing is concerned, the Thames Gateway was expected to provide over 110,000 new homes and of these, 70,000 new homes were anticipated by 2006 (RPG 9a, 1995)[1]. A significant proportion will be in London and Essex while the potential of Thames Gateway in Kent extends into the longer term. In addition to industrial and housing, commercial developments are envisaged, mostly along the riverside areas. Major catalysts for commercial development are the proposed stations at Stratford and Ebbsfleet. Most developments are expected to be of mixed uses: commercial and housing and to a certain extent, leisure.

8.6.3.1 Regeneration Programmes

The approach to implementing the policies for Thames Gateway is supported by a large number of regeneration programmes and initiatives[2] (RPG 9a, 1995). English Partnerships, with responsibility for promoting regeneration across England through land reclamation and development, include the Chatham Maritime, the Woolwich Arsenal and Barking Reach among its projects. Recent developments in the Thames Gateway are the Excel exhibition centre in the Royal Dock and with major housing schemes at Silvertown, Gallions Point and Barking Reach. In Greenwich, major developments include the Dome and Millenium Village. Map 8.2 shows the location of these major developments.

Since the government announced its interest in the development of the Thames Gateway area in 1991, some regeneration and redevelopment has been happening within the area. Out of 212 sites covering 4, 597 hectares that have been identified for development, 40 sites covering 383 hectares or 8.3% have been developed by 2001 (DETR, 2001). This included retail, employment, leisure and housing (10, 884 units). Housing development has spread evenly along the Gateway, although there have been high levels of activity in Newham and Greenwich. At the eastern end, housing units were developed in Thurrock, mainly Chafford Hundred, Medway and Swale (DETR, 2001).

[1] The housing potential in the Thames Gateway was based on advice from SEPLAN and the London Planning Advisory Committee (LPAC).
[2] These include the SRB Challenge Fund, Stratford City Challenge and the Deptford City Challenge.



Map 8.2 Key Development Sites in the Thames Gateway

Source: DETR (2001)

In February 2003, the Sustainable Communities Plan in February focused on the Thames Gateway as one of the key South East growth areas and allocated £446 million to help with land assembly, remediation of brownfield land and delivery of additional affordable housing and local infrastructure.

8.6.3.2 Transport Infrastructure

It is widely recognised that new and improved cross river links, including better transport links and local roads crossings could help stimulate regeneration in the area and ease congestion (TGLP, 1995). There have been some improvements in the rail and road infrastructure around the Thames Gateway area. These include the Jubilee Line Extension to North Greenwich and the DLR extension to Lewisham. The DLR will be extended to London City Airport. The East London line and Thameslink 2000 will be implemented on 2007 and 2012, respectively. Proposals for three Thames Gateway River Crossings include:

1. Blackwall-Silvertown Link (a two way road crossing)
2. Woolwich Crossing (extension of DLR from City Airport to Woolwich Arsenal Station (given the go-ahead in 2004) and
3. Thames Gateway Bridge crossing between Beckton and Thamesmead, Woolwich.

The Thames bridge between Beckton and Woolwich is expected to be completed by 2012. However, key issues in the Thames Gateway include: traffic growth and development resulting in increase in car ownership. Major transport related regeneration include the Channel Tunnel Rail Link (CTRL) which focuses on Stratford in East London where a new international station will link to the extended Jubilee line underground service. The developments in Ebbsfleet station will also provide another catalyst for regeneration in the Kent section of the Thames Gateway. The route of the CTRL and the location of the international stations are shown Map 8.2.

8.6.4 Institutional Context

The original implementation strategy adopted by the Planning Framework for Thames Gateway is that of partnership, rather than the creation of new administrative structures for development control and decision-making. However, recently, Government's Sustainable Communities Plan (ODPM, 2003) proposed the establishment of two UDCs to steer regeneration in the area. The Thurrock UDC was established in October 2003 covering the borough's area. The UDC has powers to determine large planning

applications but minor applications would remain with the boroughs. The UDC for the London Thames Gateway, which cover parts of five London boroughs – Hackney; Havering; Newham; Tower Hamlets and Waltham Forest, is due to be established by the summer 2004. Under this proposal, planning powers will be transferred to the UDC under the Local Government, Planning and Land Act 1980.

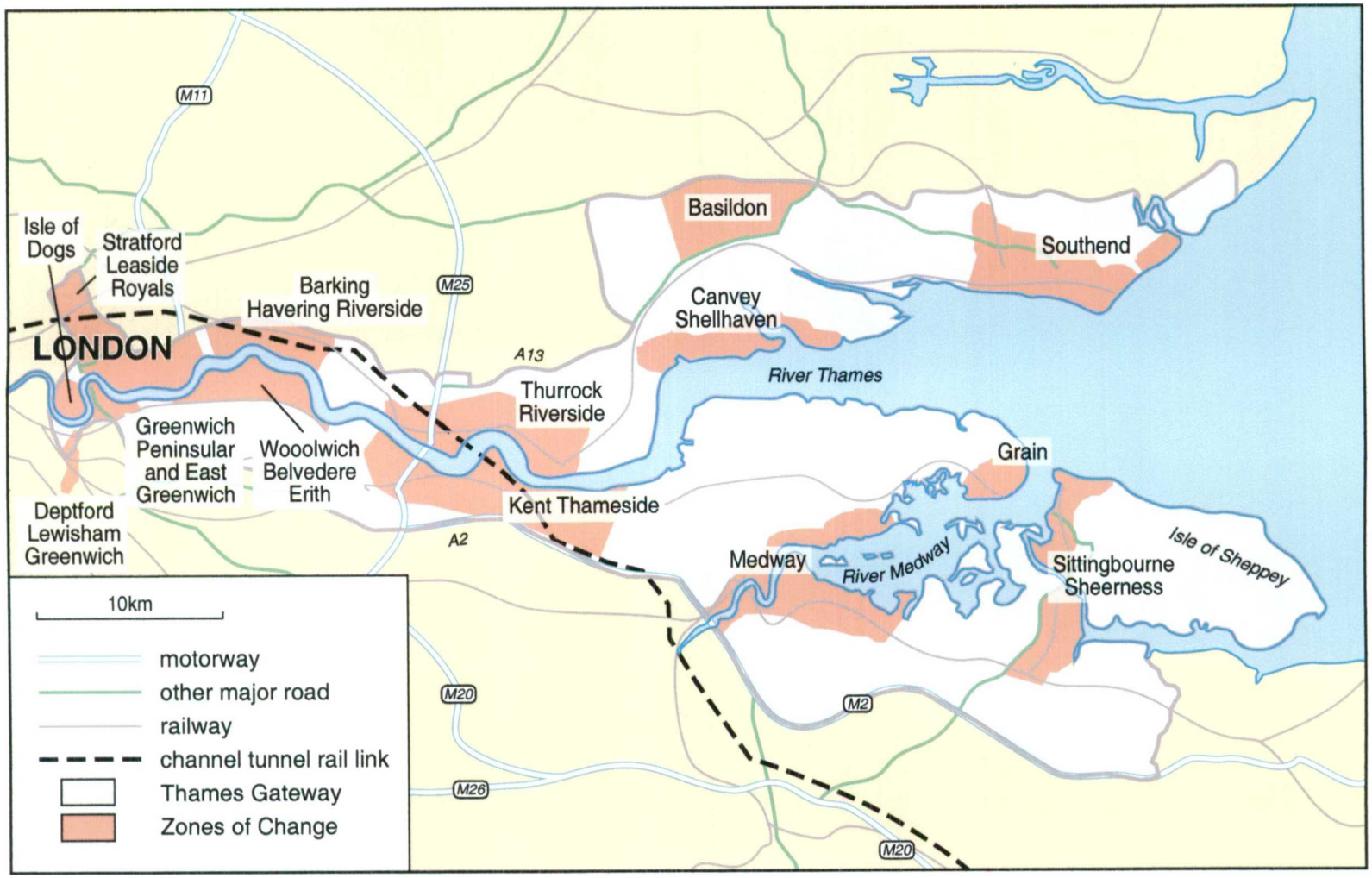
At the highest level, a Cabinet Committee headed by the Prime Minister oversees the regeneration of Thames Gateway. In 2001, the Thames Gateway Strategic Partnership was established to oversee the development of the area. This Partnership brings together Government, regional and local bodies. The Partnership has identified key 'zones of change' in the Gateway where development will largely be concentrated (Whittle and Williams, 2001). Local sub-regional partnerships, Thames Gateway London Partnership (TGLP), Thames Gateway Kent (TGK) and Thames Gateway South Essex (TGSE) have identified development areas within the zones. The zones of change are shown in Map 8.3.

The Partnership is responsible for facilitating co-ordination across the whole of the Gateway. Its key objectives include (Whittle and Williams, 2001):

- Securing the development and regeneration of the Thames Gateway over the next 20 years;
- Developing strategies and action plans together with key players in London, Kent and Essex;
- Developing a long-term strategy for the improvement of transport and physical infrastructure in the Gateway;
- Addressing major areas of social deprivation and exclusion in the Gateway;
- Implementing the Urban White Paper principles to secure a balanced and sustainable community.

The Partnership has established sub-groups to support its work on: skills, community and environment. The responsibility of the environment group is to:

- Scope the environmental structure;
- Identify strategic "hotspots" of environmental degradation in the Gateway;
- Consider flood defence and flood management issues;
- Develop an overview of the management of the Thames Marshes; and
- Promote an appropriate network of urban renaissance centres in the Gateway.

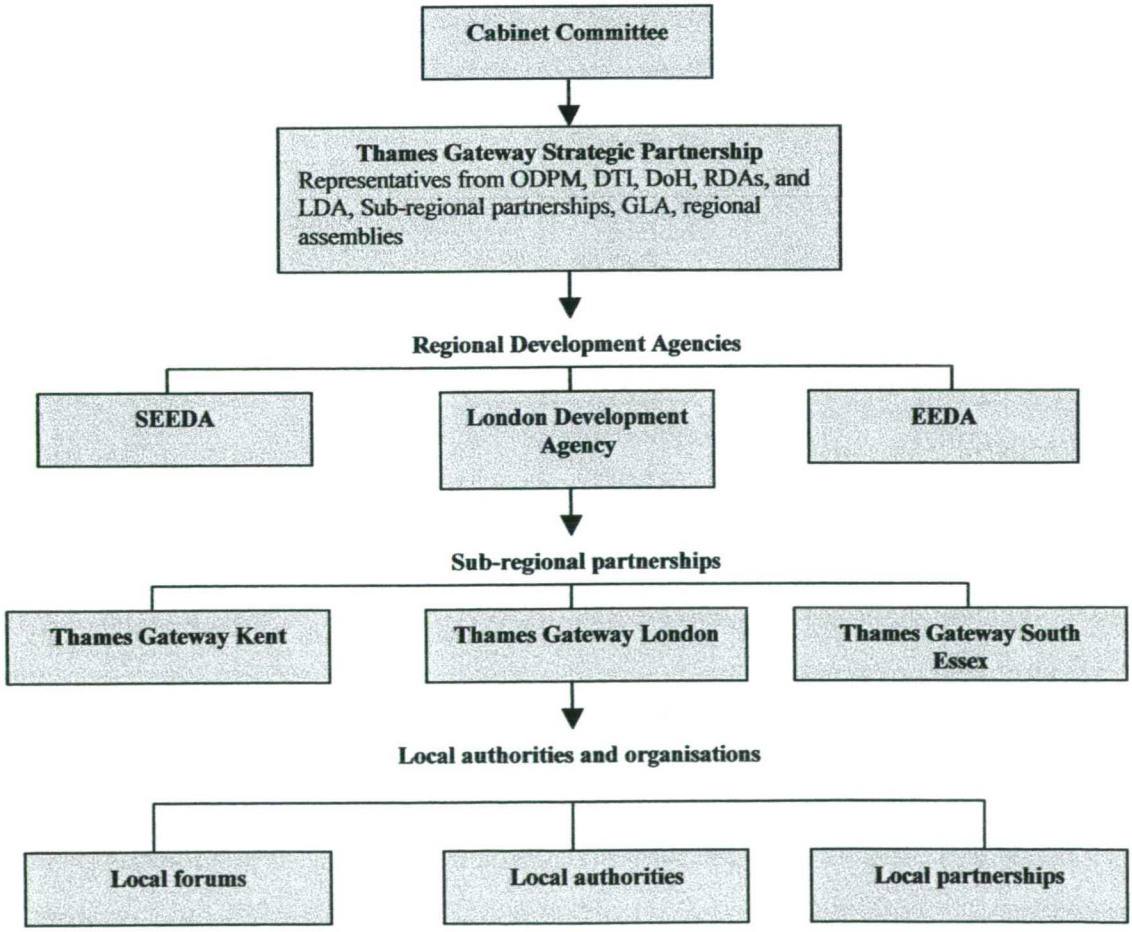


Map 8.3 Thames Gateway Zones of Change

Source: DTLR (2001)

Thames Gateway area lies within the jurisdiction of three Government Offices for the regions: London, the South East and East of England. It is covered by the Southeast of England Development Agency (SEEDA), East of England Development Agency (EEDA) and the London Development Agency (LDA). At the local level, over 20 local development agencies administer the sub-region. Partnerships have been formed among local authorities and representatives of the business community such as: Docklands East London Partnership, Kent Thameside Partnership. These organisations are responsible for producing programmes, environmental improvement initiatives and promotion. In addition to the organisations mentioned above, other public sector organisations have responsibilities relating to the environment in the Thames Gateway area. These include the ODPM, which is responsible for policy and planning and the Environment Agency, with responsibility for pollution and flood control. Other organisations with interests in the area include English Nature, the Countryside Agency and English Heritage and various interest groups such as the Thames Estuary Management Partnership. Figure 8.2 sets out the institutional framework for the Thames Gateway.

Figure 8.2 Institutional Framework for the Thames Gateway



DTI: Department of Trade and Industry; DoH: Department of Health

Organisations with responsibilities in the Thames Gateway are listed in Table 8.2.

Table 8.2 Organisations and responsibilities

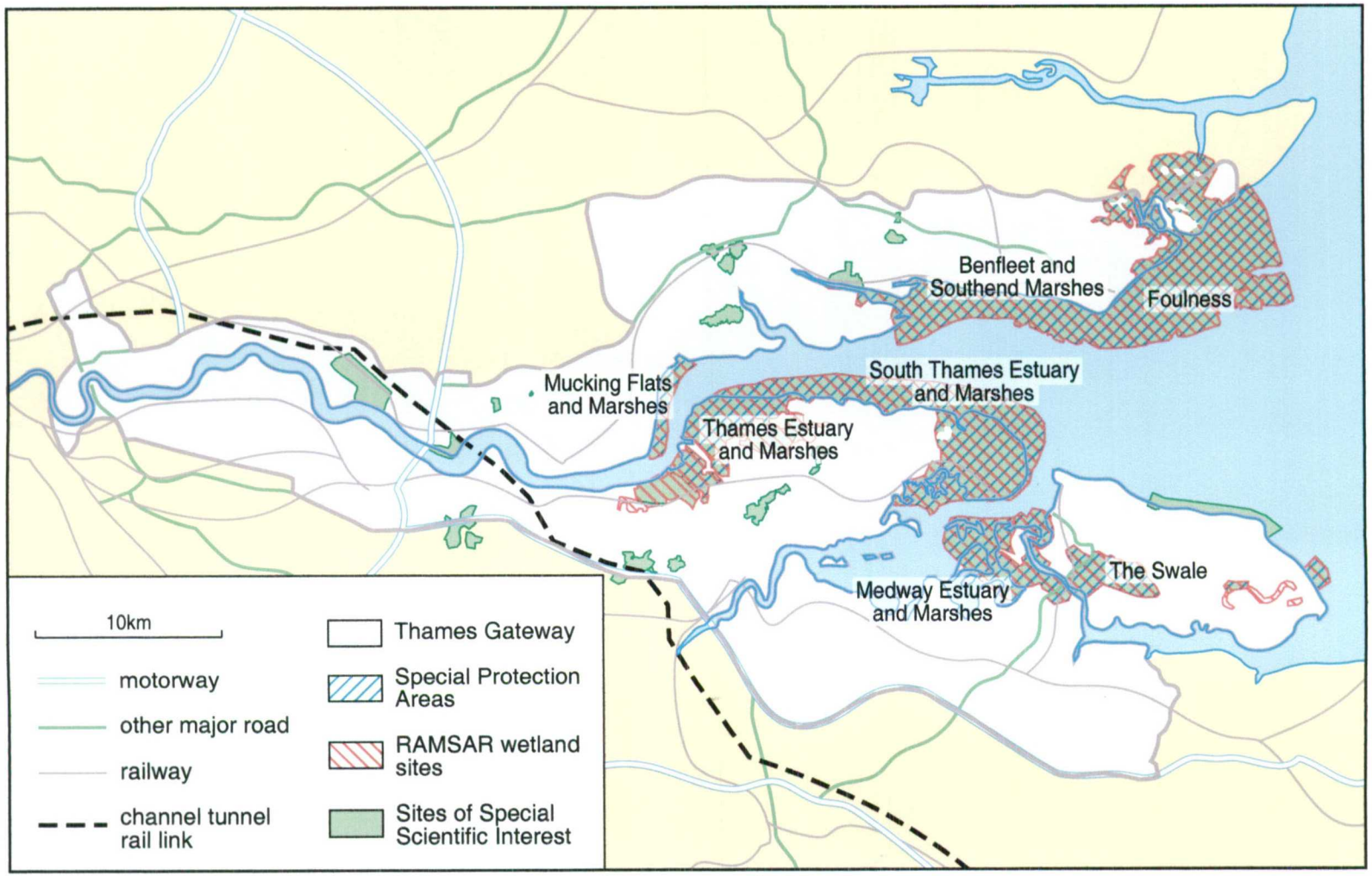
Agencies	Policy, Planning & Development	Environmental Protection & Pollution Control	Transport	Flood Control
ODPM	*			
Local Planning Authorities	*	*		
RDAs & LDA	*			
GOSE, GO-East & GOL	*			
Environment Agency		*		*
Economic Devt. Partnerships (e.g. TGLP, TGK, TGSE)	*			
London Port Authority			*	
Department of the Environment, Food and Rural Affairs (DEFRA)		*		
Department of Transport			*	
Conservation/Environmental Organisations		*		

GOSE: Government Office for the South East; GO-East: Government Office for the East of England; GOL: Government Office for London

8.6.5 Environmental Issues in the Thames Gateway

As can be appreciated, these developments are likely to cause adverse impacts on the environment if preventive measures are not taken. There are areas in the Thames Gateway, which are particularly vulnerable to development:

- Nature conservation areas in the Swale, the Medway estuary and the mudflats of Hoo Peninsula. These areas consist of a chain of estuarine habitats of international significance for overwintering birds and many nationally scarce plants and invertebrates. Extensive tracts of the marshes and mudflats of the Thames and Medway estuaries and the Swale are protected areas, either as Sites of Special Scientific Interest, as Special Protection Areas under the EC Birds Directive and as wetlands under the Ramsar Convention. Map 8.4 shows the location of nature conservation areas.
- Intertidal mudflats higher up the Thames are also considered a significant ecological resource. To sustain the quality of these habitats, an understanding of the natural coastal processes and effective management of the coastal zone is required (RPG 9a, 1995).
- Other ecological resources in the area that may not have international or regional significance are locally designated sites such as grasslands, reedbeds and saltmarsh (Llewelyn Davies et al, 1993). The above study identified 185 acres of locally designated land as potentially affected by development proposals.



Map 8.4 Nature Conservation Areas in the Thames Gateway

Source: Environment Agency (2002)

- In the particular case of salt marshes and mudflats, there has already been a gradual erosion of saltmarshes in Kent and Essex. In Essex, an Environment Agency study found that agricultural use, reclamation for industrial use and construction of sea defences have already contributed to the gradual erosion of saltmarshes and mudflats (Potter, 2000).
- Other areas that could be affected by development are Metropolitan Green Spaces and parts of the Green Belt.

To address this last issue, the Government issued "*Creating Sustainable Communities: Greening the Gateway: A green spaces strategy in the Thames Gateway*" (ODPM, 2004) which outlines the Government's vision for ensuring that publicly accessible green spaces are integrated into plans to develop the area. The strategy safeguards a network of green spaces consisting of urban parks, woodland, meadows, wetlands and farming countryside.

Unfortunately, this strategic approach has not been extended to address all the other environmental effects of the regeneration plan. The Thames Gateway Review (2001) has recommended that an environmental appraisal of RPG 9 should be undertaken. However, the Thames Gateway Strategic Executive's position is that there is no need for a sustainability appraisal for the Gateway since the regional assemblies (SEERA, EERA) and the GLA will be producing sustainability appraisals for their parts of the Gateway (Williams, 2003).

Potential cumulative effects issues relating to the development of Thames Gateway were identified in the first Interview Survey carried out as part of this research (see Chapter 9). The 28 interviewees were asked to give examples of cumulative effects and eighteen interviewees who had some interest or responsibility in the Thames Gateway were asked for examples of cumulative effects issues in the area. In addition, causes as well as receptors of impacts were discussed. The main stressors identified were housing and transport infrastructure provision. The main cumulative effects issues identified and the number of interviewees who referred to those issues were: traffic & transport (13), air pollution (11), flooding (11), water resources (9), biodiversity/ habitat loss (9), open spaces (6), waste (4) and impact on utilities and services (7). Table 8.3 shows the types of cumulative effect issues and possible causes identified.

Table 8.3 Cumulative effects issues in the Thames Gateway

Cumulative Effects issues	Causes
Increase in traffic and congestion	increase in transport movement and commuting
Increase in air pollution	greater use of private vehicles industrial releases of nitrogen oxides
Increase in flood risk	many new developments (housing) on or close to the floodplain increase in water run-off from built up areas sea level rise and climate change farming practices
Reduction in water supplies and groundwater contamination	many new developments (commercial and housing) in the area
Habitat loss and fragmentation	use of land for development and transport infrastructure
Loss of open spaces and disruption to network of green spaces	development on open spaces and brownfield sites
Loss of intertidal area; erosion of salt marshes	sea level rise encroachment
Increase in waste production	increase in industrial, commercial and residential activities
Impact on water quality of estuary and rivers and on freshwater and marine habitats	increased activity on riverside
Increased demand for utilities (electricity), and services (schools, health and recreational facilities)	growth in population
Impact on urban environment (increase in noise)	traffic, construction activities
Impact on health	traffic, noise, air pollution
Positive impacts on environmental quality-improved public spaces, public transport, visual quality	urban regeneration programmes: redevelopment of derelict sites, improvement in design standards, provision of public transport, pedestrian & cycle lanes

A main issue of concern was air pollution. The increase in number of developments and use of vehicles were seen as contributing to potential cumulative impacts on air quality. This supports studies on the Thames Gateway, which found that the vehicles would be the main source of pollution in the area (HMIP, 1993; Kimova-Murphy and Fisher, 1997).

Key issues for transport in the Thames Gateway include (TGLP, 2002):

- transport growth: with new development and major increases in car use and freight traffic;
- highways: there is significant traffic congestion on key routes such as the A13, A127, A2 and South Thames Development Route;
- rail: there are insufficient networks and interchanges to connect key centres;
- buses: transport services circuitous or impractical;
- cyclists and pedestrians: poor travel conditions.

Another area of concern related to water resources. The South East is the driest region in the country and if the proposed developments go ahead there will be increased demand for water, which could result in water supply shortages in some areas (SEERA/Environment Agency, 2002). Another important issue was flooding. Large areas of the Thames Gateway are in the flood plain and any encroachments onto the foreshore constrict the river channel and causes water levels to rise. The incremental effect of small-scale developments on floodplains can be important (Environment Agency, 1998). The Environment Agency suggests that unless flood defence measures are taken to compensate for these effects, there will be a greater risk of flooding and larger numbers of people exposed to flood risk. The Thames Barrier will need to be raised by 2030 to continue to cope with rising flood risk (Environment Agency, 2003b). This is particularly significant since the baseline is far from static, with predicted effects of climate change bringing rising sea level and flood event frequency to the Thames. In the event of climate change, eastern England, which includes large parts of the Gateway is the most vulnerable region in the country to water shortages, sea level rises and flooding (East of England Sustainable Development Round Table (2003).

Other environmental issues related to waste management, energy and resources use. Increase in economic activities and housing in the area could result in greater demand for services and utilities. Health and electricity problems[3] are the important challenges (Marrs, 2004). Their cumulative effect could lead to lower environmental quality for the existing and new communities. On the other hand, there are likely to be positive environmental impacts, such as redevelopment of derelict sites and cleaning up of contaminated areas[4].

8.7 Summary

This chapter explored environmental issues relating to urban regeneration in general and the Thames Gateway in particular. It established the context for cumulative effects issues that will be investigated in more detail in the application of the CEA framework (see Chapter 10). The next chapter discusses the development of the framework.

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[3] Many areas of the Gateway are too remote to be linked to the existing electricity grid without substantial and expensive works. Furthermore, additional funding will be required for health facilities, where some facilities do not meet minimum standards. The proposed 91,000 homes will require 19 new primary care centres, 65 new schools, six new police stations and three fire stations (Marrs, 2004).

[4] Recently, the Land Restoration Trust was set up to facilitate greening of environments contaminated by by industrial activity and it is looking at sites in the Gateway for possible regeneration, such as the Rainham Marshes (Willis, 2004).

Chapter 9. Developing the Framework

9.1 Introduction

The review of EISs (see Chapter 6) and the literature have demonstrated the limitations of project EIAs in addressing cumulative effects. Environmental assessment at strategic level would allow for these impacts to be better addressed because it is undertaken at an earlier stage in decision-making and so it can consider a wide range of actions over a greater area (Wood and Dejeddour, 1992; Pritchard, 1993; Sheate, 1996; Therivel and Partidario, 1996; Stinchcombe and Gibson, 2001). However, the findings from the review of environmental/sustainability appraisals revealed that these effects are generally not being considered (see Chapter 6). The consideration of cumulative effects is limited by a lack of common understanding of the concept, appropriate guidance and a strategic framework within which they can be evaluated. In this context, a semi-structured interview survey of 28 experts and practitioners was carried out to establish current understanding of cumulative effects, to seek their opinion on what the role of CEA in planning might be and how CEA could be integrated into the strategic planning process. Chapter 5 indicated how CEA might be integrated into planning and a number of options were explored in the interview survey: CEA integrated into sustainability appraisals; integrated into SEAs; a CEA framework for plans and strengthening CEA at project level by widening its scope.

This chapter begins by discussing the interview results. The interview survey was undertaken to answer the research question: *How could CEA be integrated into the strategic planning process?* The findings from the interview survey, including a discussion of the role of CEA in SEA and the implications of integrating CEA into the strategic and SEA process has been published as:

Cooper, L.M. and Sheate, W.R. (2004). Integrating cumulative effects assessment into UK strategic planning: implications of the European Union SEA Directive. *Impact Assessment and Project Appraisal.* 21(1) pages 5-16.

The approach for developing the CEA framework is presented in section 9.4. As discussed in Chapter 8, urban regeneration was chosen as the focus for exploring cumulative effects issues. Since urban regeneration strategies are planned developments, they provide an opportunity to address cumulative effects at the strategic

planning level. The elements of the framework and the network analysis method are discussed in detail from section 9.6.

9.2 The interview survey

Twenty-eight interviewees were selected on the basis of their interest in the EIA and planning processes. These included government regulators (at national and regional levels), planners, statutory environmental consultees (including the Environment Agency and English Nature), regional development agencies and the Government Office for the Southeast [of England], environmental NGOs (national and those operating in Southeast England), academics, EIA consultants involved in SEA and sustainability appraisal, and urban regeneration partnership administrators. A range of experts and practitioners in the fields of environmental assessment, planning and development were interviewed to have an insight into current awareness and understanding of cumulative effects. Since the focus of this research is on the cumulative impacts of urban regeneration in the Thames Gateway, most of those interviewed (eighteen) were from the Southeast of England region. Before the interview, the interviewees were sent some background information on the research and examples of questions to be asked. Most of the interviews were taped and transcribed soon after, within a day or two. Because of the distance involved, a couple of interviews were conducted over the telephone. The interviews lasted from one to two hours. The interviews were undertaken from May 2002, before the Government's draft guidance on SEA was issued. At that time, discussions were still being conducted on how to incorporate the requirements of the Directive into the existing sustainability appraisal process. The interviewees are listed in Table 9.1

Table 9.1 Interviewees and organisations

Interviewee	Organisation	Position
National Government		
David Aspinwall	Former DTLR (Environmental Assessment Branch)	Head of Environmental Assessment Branch- responsible for implementing the SEA Directive in the UK
Paul Williams	ODPM (Urban Policy Unit)	Head of Environment Sub-group, Thames Gateway Strategic Executive
Chris Vivian[1]	DEFRA (CEFAS)	Topic leader – involved in assessments of major developments, including those in the Thames Gateway
Regional Offices		
Simon Richardson	SEEDA	Nature Conservation Officer
David Payne	SEERA	Regional Planner- responsible for RPG
Eike Muller[2]	GOSE	RPG team leader

[1] Sian Boyd and other members of the marine aggregates team (from CEFAS) also present
[2] Paul Fellows (planner, GOSE) also present

Interviewee	Organisation	Position
Lesley Creedon	GOSE	Kent planning team leader- provides advice on the Thames Gateway
Statutory Consultees		
Peter Massini	English Nature London	Conservation Officer for east London
Rachael Hill	Environment Agency Thames Estuary Flood Risk Management Plan	Habitats and planning strategist
Hugh Howes	Environment Agency Thames Region	Regional strategic planner (water resources and flooding)
Dianne James	Environment Agency Thames Region	Partnerships Officer, Thames Estuary
Environmental Organisations		
Andrew Dodd	RSPB	Development Plans Officer
Gavin Bloomfield	RSPB - southeast	Nature conservation officer
Caroline Arnold	Thames Estuary Partnership	Formerly Co-ordinator now Environmental Resources and Policy Manager, Kent County Council
Martin Hall	Medway and Swale Estuary Partnership	Co-ordinator
County/Local Planning Authorities		
Thomas Jones	Surrey County Council	Environmental Assessment Officer
Mike Sammonds	Greenwich Council	Sustainability Officer- Forward Planning
Abigail Raymond[3]	Kent County Council	Strategic Planner
Leon Yates	Lewisham Council	Planning Officer- Regeneration
Urban Regeneration Partnerships		
Mary Spence	Thames Gateway South Essex Partnership	Chief Executive
Alex Nickson	Thames Gateway London	Sustainability Officer and Project Officer for the Thames Strategy East (Thames Estuary Partnership)
Jackie Sadek	British Urban Regeneration Association	Deputy Chairman
Consultants		
Roger Levette	Levette-Therivel Consultants	Partner - involved in sustainability appraisals
Clive Harridge	Entec UK	Director –involved in sustainability appraisals and producing guide to sustainability appraisal for RTPI
Academics		
John Zetter	UCL (formerly DETR)	Visiting Professor -previously involved in implementing environmental appraisal of plans
Riki Therivel	Oxford Brookes University (School of Planning)	Visiting Professor - author of several books on SEA
Jake Piper	Oxford Brookes University (School of Planning)	Lecturer - undertaken research on CEA
Other		
Karl Fuller	Institute of Environmental Management and Assessment	General Manager – involved in various aspects of EIA

The issues identified in the literature such as: lack of common understanding of the concept, appropriate methods and framework for CEA (see Chapters 4, 5 and 7) informed the consultations. The aim was to find empirical evidence relating to those issues through the interview survey. The interview schedule consisted of two parts: the

[3] Helen Martin (planner, Kent County Council) also present

concept of cumulative effects and the role of CEA in planning; and approaches for considering cumulative effects in strategic planning. A copy of the Interview Schedule is included in Appendix 5.

9.2.1 Understanding of cumulative effects

The level of understanding of what cumulative effects are and how these effects can be assessed were variable. The criteria used for measuring the level of understanding were based on the definition and examples of cumulative effects provided by the interviewees. Definitions were classified into three levels: *Level 1* consisted of no understanding of the concept or were unsure what cumulative effects meant. *Level 2* showed rudimentary understanding (e.g. total or sum of effects). *Level 3* demonstrated some understanding of the more complex characteristics (synergistic or compounding) effects. Some interviewees, such as government regulators, urban regeneration partnership administrators and environmental partnership organisation officials had a lower understanding of cumulative effects than planners, environmental NGO officers and consultants. In general, there was no consensus on what cumulative effects mean. This suggests a lack of clear or common understanding of the concept among those involved in the EIA and planning process. These findings confirm the lack of clear understanding among practitioners that was evident in a survey of 50 UK EIAs (see Chapter 6), which came up with eight different interpretations of cumulative effects (Cooper and Sheate, 2002). The main definitions of cumulative effects given during the interviews were:

- Cumulative effects are the total effects on the whole system or overall impacts
- Cumulative effects are impacts by the action elsewhere or on others
- Cumulative effects are interaction of impacts and policies

Comparing the types of cumulative effects identified by the interviewees with a typology of cumulative effects adapted from Spaling (1994) further illustrates the levels of understanding of cumulative effects among practitioners and regulators. Spaling (1994) grouped the effects into two categorises: functional (time crowding, time lags) and structural (space crowding, cross boundary, fragmentation). This author stated that other types of cumulative effects, such as compounding, indirect and thresholds are indicative of the manner of accumulation. Most of the interviewees defined cumulative effects as the '*sum of impacts*' while fewer interviewees characterised cumulative effects as '*synergistic' or 'compounding*'. The interviews revealed that the majority of

the interviewees' understanding of cumulative effects is that such effects are primarily additive in nature. There was less reference to the more complex characteristics of these effects, such as their compounding or synergistic ways of accumulating. For example, Barrow (1997) lists other types of cumulative effects such as '*surprise effects*' and '*impacts from feedback processes*' which were not referred to. Some interviewees commented that cumulative effects cover a lot of meanings and are complex in nature. The types of cumulative effects identified in the interview survey are shown in Table 9.2. Also included in the table are the types of cumulative effects identified from 50 UK EIAs reviewed (see Chapter 6) and published as Cooper and Sheate (2002), in order to compare the findings from the interviews with EIA practice. The table shows that in the project EIAs, the concept of cumulative effects was limited to project related effects and did not include so-called '*nibbling*' effects.

Table 9.2 Types of cumulative effects identified in the interview survey and EIAs

Typology of cumulative effects	Cumulative effects types and characteristics identified in survey and no. of interviewees who referred to such effects	Cumulative effects identified in review of EIAs *(Cooper and Sheate, 2002)*
Incremental (additive) (repeated actions of a similar nature) - time crowding - space crowding	✓ effects of additional impacts over time (15)	✓
Time lags or delayed effects	✓ effects over time (5)	
Cross-boundary movement	✓ impacts occur elsewhere (3)	
Fragmentation	✓ fragmentation of habitats (3)	✓
Compounding/ synergistic effects	✓ effects from multiple causes & processes (7) ✓ interaction of impacts & policies (2)	✓
Indirect effects; secondary or higher order effects	✓ indirect and secondary impacts (2)	✓
Nibbling effects	✓ lots of small impacts (5)	
Triggers and thresholds	✓ thresholds reached due to impacts (3)	

Typology adapted from: Spaling (1994)

9.2.2 Cumulative effects issues

The interviewees were asked to give examples of cumulative effects. Interviewees who had any involvement in the Thames Gateway were asked for examples of cumulative effects issues in the area and their possible causes. The results are shown in Chapter 8. Some cumulative effects issues that were identified were: traffic, air and water pollution and habitat loss and loss of open spaces.

9.2.3 Role of CEA in planning and decision-making

When asked to what extent CEA can assist planning and decision-making, nearly all the interviewees except one were positive that CEA can make a useful contribution to strategic planning. Some of the responses from the interviewees and the number of interviewees who provided those statements are listed below.

- CEA can be used to assess overall effects (5 interviewees)
- CEA can inform policy (5)
- Inform decision-makers so that they can reach better decisions (7)
- Inform choices (such as allocation of sites and land use) (6)
- Assist in management and mitigation at plan level (4)
- CEA can help planning to be more proactive and direct the process (6)
- Other comments: helps understand cause-effect relationships and impact links, assist long term planning and transparency in the process.

One interviewee stated that cumulative effects are already taken account of in the planning process and another interviewee commented that there is already an assumption that these matters are considered in policy direction. However, another interviewee observed that the planning system is designed to be holistic, but it is weak on incremental losses such that gradual degradation, for example, is missed and not considered in planning applications. A systematic approach to addressing cumulative effects at a strategic level would therefore be useful in the ways suggested above as well as taking account of incremental losses that are missed in the CEA in EIA development control model.

9.2.4 Appropriate planning level for conducting CEA

The interviewees were asked what would be an appropriate strategic planning level for assessing cumulative effects. This was to identify where a CEA framework could be useful and capable of being implemented while considering the planning process at each of the following levels:

- Regional planning process, through regional planning guidance or regional strategies (e.g. economic, transport, spatial)
- Local planning process, through development plans or the newly proposed local development frameworks
- Programme or master plan level (clusters of projects or an overall plan for an area of regeneration)

- Integrated at all planning levels.

Half of those interviewed (14 out of 28 interviewees) preferred that CEA should be integrated at all levels of planning. The remainder were of the opinion that cumulative effects should be considered at one or more of the following levels: regional level (3 interviewees), local plan level (5 interviewees), master plan/programme level (2 interviewees) and others were not sure. Six interviewees stated that CEA at regional level would be vague and more difficult and that it would be easier to assess cumulative effects at the plan or programme level.

One interviewee suggested that CEA could be used as a tool for determining housing distribution at the regional level and at the local or district plan level, CEA could be used to assess the distribution effect on services and utilities. She also suggested that CEA could be useful in assessing cumulative transport impacts and this could influence transport strategies at different levels.

Opinions were sought as to what cumulative effects issues can be addressed at each planning level. Some interviewees suggested that cumulative impacts such as flooding and air quality should be addressed at regional or sub-regional levels, while more localised cumulative effects, such as noise and visual impacts could be addressed at the local or sub-local plan (master plan or programme) level. Three interviewees suggested that cumulative impacts on open spaces should be dealt with at a strategic level because of the necessity of assessing the whole of the green spaces network.

9.2.5 Options for addressing cumulative effects

From the literature and analysis of current planning and assessment processes, four options or approaches for integrating CEA into the planning process were presented to interviewees:

- CEA integrated into sustainability appraisals of plans
- CEA integrated into SEA of plans
- A CEA framework for the plan area
- Strengthen CEA at project level by widening scope

Most of those interviewed stated that CEA should be conducted within existing frameworks such as part of Sustainability Appraisals (8 interviewees) (28%) and SEAs

(14 interviewees) (50%) and Regional Sustainability Frameworks (1). However, one interviewee said that it might be difficult to incorporate CEA into sustainability appraisals because cumulative impacts of policies may not be so easily assessed. No one chose a separate CEA framework for the plan area and the reason given was that it would not be practical to introduce a new process. One interviewee preferred the last option, which was to strengthen CEA in project EIAs.

9.2.6 Useful features of a CEA framework

Most interviewees (17) stated that a tiered approach to CEA would be useful: from policy, to plan and programmes. There were many suggestions as to what features a CEA framework should have to make it feasible. These features had to do with: *approach, process, practicality, implementation and information requirements*. One interviewee suggested that guidelines on how to do a CEA would be useful, particularly with regard to finding information required for the assessment. He suggested that a series of questions at each stage would be useful as well as suggestions on '*who to talk to*' and '*where to look up information*'. The features and the number of interviewees suggesting each element are shown in Table 9.3.

Table 9.3 Features of CEA Framework for plans

Features	No. of interviewees
Approach	
Define what is meant by cumulative effects, cause effects relationships and how to consider such effects	9 (32%)
Adopt a strategic / ecosystem approach	11 (39%)
Conduct CEA within wider appraisal processes, such as integrate into SEA	7
Focus or prioritise important issues or effects	11
Provide context/linkage with project EIAs	12 (43%)
Process	
Set objectives and specify at what point cumulative effects are considered in planning process. Consider early, at scoping stage of plan	9
Set boundaries broadly	4
Use state of environment reports and detailed information for the baseline	6
Use indicators, thresholds, benchmarks and trigger levels Provide guidelines on establishing thresholds	9 2
Base assessment on sensitivity of affected resources and incorporate risk assessment approach	9
Define role of agencies involved and who undertakes the CEA	5
Define public involvement	3
Include monitoring and management	3
Provide guidelines on how to set criteria for significance	3
Focus on outcome: how the CEA process could be implemented, how to enforce it, how useful it is to the decision maker and how it would improve planning	5
Set quality standards	2
Use precautionary principle	4
General	
Should be practical, straightforward, in easily available form and use sensible criteria	9
Provide advice on information: how to access information; what to do with information	2

9.2.7 Constraints to CEA at strategic level

There were several constraint areas identified in implementing CEA at strategic levels: *conceptual, administrative, technical, and informational.* Some of these constraints have also been identified in project EIA CEAs (Fuller and Sadler, 1999; Piper, 2001). Constraints identified in the interviews and the number of interviewees who referred to those are summarised in Table 9.4.

Table 9.4 Constraints to CEA at strategic level

Constraints	No of interviewees
CEA in general	
Conceptual: lack of knowledge and understanding of cumulative effects and CEA	13 (46%)
Lack of guidance on CEA	5
Technical difficulties at strategic level	
Lack of data or access to data, particularly on future developments	7
Difficulty in prediction, lack of models	7
Planning is territorial and based on administrative boundaries while effects could cross boundaries	2
More impacts to consider such as gradual degradation and so assessment more vague	4
Difficulty in proving causal link	2
Capacity and resources	
Planners' lack of time, knowledge and experience of CEA	5
Political will and source of funding required for the assessment	2
No policy/planning framework for CEA	3

9.3 Integrating CEA into strategic planning

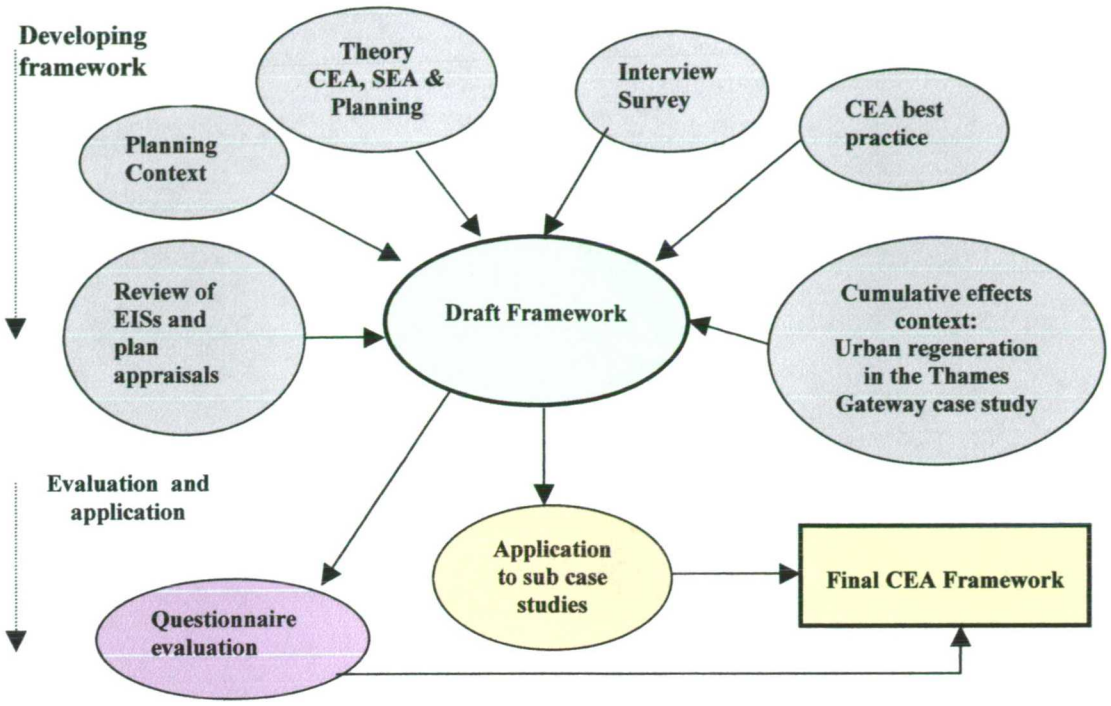
The survey findings indicated that CEA should be integrated into strategic planning as part of SEA. As the literature review has shown, CEA and SEA are closely linked (see Chapter 7). The analysis of cumulative effects are facilitated by SEA by permitting an early, overall look at potential relationships and impacts and the scope of SEA is more appropriate to the time and spatial scales at which cumulative effects occur (Sadler, 1996). SEA has been promoted as a means of dealing with cumulative effects assessment and is seen as providing a context and rationale within which to address cumulative effects which are not normally addressed on a project by project basis (Therivel and Partidario, 1996; Barrow, 1997; Fuller and Sadler, 1999). Likewise, SEA facilitates a planning approach to addressing the cumulative effects of projects that occur as a result of decision-making processes (Bonnell and Storey, 2000) and could be used to support the subsequent assessment of cumulative effects of projects (Davey *et*

al, 2002). On the other hand, if SEA is to be effective in policy and plan making, it should have regard for cumulative, regional and long-term impacts. CEA can contribute to this process by identifying significant impact interactions between relevant policies, plans, programmes and proposals. In terms of approach, both CEA and SEA are environmental assessment frameworks, which follow the rationalist model.

9.4 Designing the draft framework

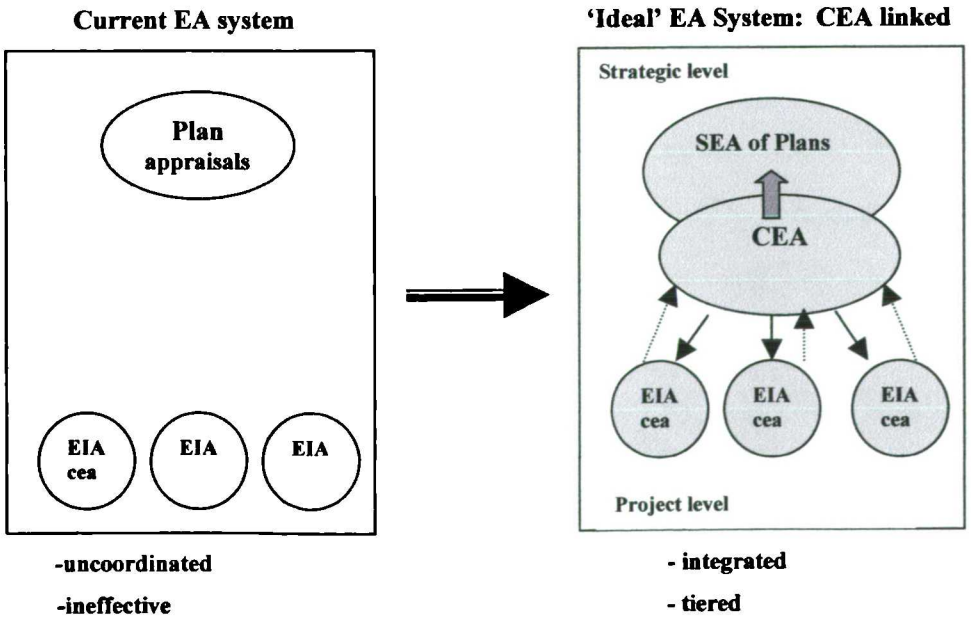
Based on the results of the interview survey, which suggested that CEA should be integrated into SEA, the next step for the research was to design a draft framework for undertaking CEA within the SEA and plan-making processes. The draft framework was designed based on the literature review, findings on best practice elsewhere, the results of the CEA practice survey and the interview survey, government guidance on planning and plan preparation and the requirements of the SEA Directive. The overall framework approach follows that of Damman *et al* (1995) which has the following characteristics: it is 'doable' given the available information, based on available data and applicable techniques, focused on valued resources and related to agency responsibilities for implementing the findings. The framework also adopts a tiered approach as proposed by Kalff (1995) and Kingsley (1997). The proposed method, network analysis, is based on the approach developed by Lane *et al* (1988), which was modified and applied by Court *et al* (1994) to analyse the impact of development in the Coastal Zone of Australia. Network analysis is a qualitative approach, which can be useful in conceptualising cumulative effects. As Stinchcombe and Gibson (2001) observed, intractable difficulties with quantifying many ecological and socio-economic effects and risks may make the use of complex techniques prohibitive in SEA. They suggested that simple and flexible approaches with an emphasis on qualitative data might be preferable because they can allow practitioners to concentrate on the range of effects. The approach for developing the framework is shown in Figure 9.1.

Figure 9.1 Approach for framework development



Initially, a conceptual model of EA systems was drawn up showing current practice and the 'ideal' system to guide the design of the framework. The findings from CEA practice survey revealed that cumulative effects are not being addressed at both strategic and project levels. If cumulative effects are to be addressed, then there is a need to move from the current system to an ideal one. The ideal system is one in which strategic CEA is part of SEA and strategic planning which then provides a framework and context for CEA in project EIAs. This is shown in Figure 9.2.

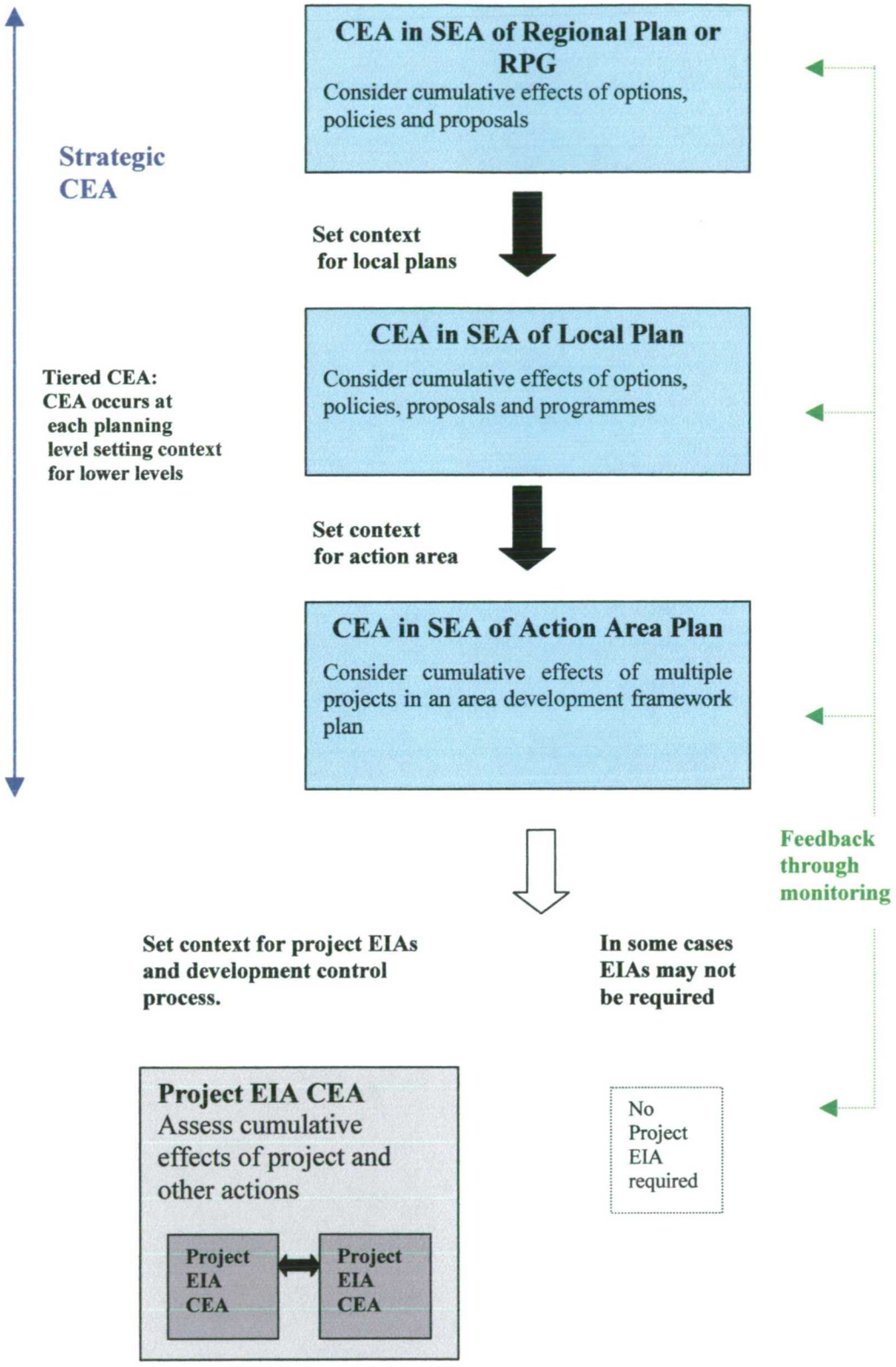
Figure 9.2 Models of Environmental Assessment Systems



The next step was to translate this theoretical model into the planning and SEA systems by defining the role of strategic CEA at each planning level- regional, local, sub-local and what cumulative effects issues could be addressed at each level. Figure 9.3 sets out how CEA can be integrated into the different planning levels.

As indicated in Figure 9.3, there are two levels where SEA is required under the SEA Directive: regional and local planning levels (local development plans, mineral plans, transport plans). CEA could also be undertaken for SEAs of plans at sub-local levels, such as action plans or area development plans (e.g. urban regeneration area). Each CEA would be addressing cumulative issues relevant to each planning level. At the higher levels, the assessment focuses on strategic issues, such as options, policies, other plans and their effects on valued resources. Box 9.1 lists some CEA issues to address at each planning level.

Figure 9.3 Integrating CEA into the planning system



Box 9.1 CEA issues to address at different planning levels

CEA in SEA of regional plans
- environmental or landscape characteristics of the region and parts of the region
- regional valued resources (environmentally sensitive areas and resources at risk in the region) that are likely to be affected by the plan (strategy, options, policies)
- environmental objectives, thresholds, indicators and trends relating to the valued resources
- growth areas and their direct, indirect and induced impacts
- impacts from infrastructure to support growth areas (e.g. transport, utilities)
- cumulative effects problems due to land use changes such as "nibbling" or gradual loss of habitat
- other plans or proposals that are likely to affect valued resources
- past actions that have affected valued resources
- cause-effect linkages to identify higher order impacts
- criteria for determining significance of cumulative impacts
- regional mitigation and monitoring measures relating to cumulative effects

At this level, area wide strategies that are likely to affect valued resources are considered. For example, the cumulative impacts of housing distribution options on regional valued resources can be considered.



CEA in SEA of Local Development Plans
- Characteristics of the environment and environmental objectives
- valued resources in the region and plan area (resources at risk that might be affected by the plan options, policies and proposals)
- status of valued resources: thresholds, indicators and trends
- growth inducing activities and their secondary impacts
- gradual loss of open space or habitats due to "nibbling" from small developments (e.g. housing projects, golf courses, garden centres)
- other plans and proposals affecting valued resources
- past actions that have affected valued resources
- cause-effect linkages relating to impacts
- criteria for determining significance of cumulative effects
- mitigation and monitoring of cumulative effects

At this level, the cumulative impacts of housing provision on valued resources such as greenfield/brownfield land, facilities, services and utilities can be considered. .



CEA in SEA of Action Area Plans
- environmental characteristics and objectives for the area
- status of valued resources: thresholds, indicators and trends
- past, present and likely future developments in the area affecting valued resources
- potential cumulative effects from the interaction of impacts from developments
- cause effect linkages to identify higher order impacts
- cumulative effects of the projects in the context of the wider area/region
- overall mitigation measures for cumulative effects
- monitoring of cumulative effects and residual effects on valued resources

CEA could be used in evaluating the cumulative impacts of developments within an area development framework.

In designing the framework, there were several considerations. Firstly, CEA issues identified from the literature review: setting boundaries, identifying linkages, thresholds and methods. Secondly, the limitations in CEA practice in the UK identified in the interview survey: lack of understanding of the concept, the need to define what CEA

might involve at strategic level (i.e cumulative impacts of policy as opposed to project impacts) and the need for practical methods that planners can use. These two factors determined the framework approach. The third consideration concerned the form that the framework should take, so that it could be of use to planners and practitioners. The interview survey and the literature review identified the need for CEA guidance at strategic level. At present there is no guidance on incorporating CEA in SEA since existing guidance for CEA are mainly for project EIAs (US CEQ, 1997; Hegmann *et al*, 1999; Hyder, 1999). It was decided therefore that the framework would be designed in the form of guidance that could be useful to planners and practitioners.

Guidelines provide information on implementing frameworks, complementing and supplementing the "bare" legal requirements and provide guidance on the initiation of activities, their design and appraisal, authorisation and subsequent implementation and management (Roe *et al*, 1995). In this case, guidelines should therefore present an approach and procedure relevant to the real tasks and problems to facilitate assessment of cumulative effects.

A CEA framework in the form of guidance was designed for land use plans under the present system and the proposed Local Development Documents but could also be applied to Regional Spatial Strategies and other plans to which the SEA Directive will apply. The draft framework is intended to supplement and complement SEA guidance by integrating CEA into the SEA process. When the framework was being developed, the ODPM had issued their draft guidance on SEA (ODPM, 2002a) and this was used as the basis for the SEA process[4]. The plan-making process was based on *Making Plans: a practical guide* (ODPM, 2002b).

9.5 Guidance structure and approach

The draft framework consisted of two main parts: i) background and context and ii) the CEA Framework. The framework was divided into 11 sections, with the first three sections providing an introduction, the guiding principles and the approach.

In designing the draft framework, there were issues that needed to be considered. First is the question of current appraisal practice in the UK, which is the use of sustainability

[4] Since then, the ODPM has issued consultation papers on the implementation regulations and guidance on SEA and SA (2 March 2004) and these were taken in account in revising the guidance (Chapter 11).

appraisals as discussed in Chapter 5. Sustainability Appraisal will be mandatory for Local Development Documents and Regional Spatial Strategies under the Planning and Compulsory Purchase Act[5] but the future requirements for Sustainability Appraisals in order to meet the requirements of the SEA Directive has not yet been defined.

In the meantime, the question is what the relationship between Sustainability Appraisals and SEA is likely to be. These processes differ in terms of their overall aims and in terms of their procedural and methodological requirements (Smith and Sheate, 2001). Sustainability appraisals are 'objectives-led' and so strategic options are assessed against sustainable development objectives whereas the SEA Directive adopts a baseline-led approach in which the alternatives are assessed against a baseline. Smith and Sheate (2001) suggested that a hybrid approach or 'Integrationary SEA' approach in the context of regional-level sustainability appraisal should be adopted since the SEA Directive acknowledges the use of objectives. 'Integrationary SEA' is one in which impacts are appraised against a combination of baseline survey data and aspirational objectives (Sheate *et al*, 2001). Smith and Sheate (2001) maintained that sustainability appraisal is widely used and therefore should be retained and at present, analysing appropriate baseline data at the strategic planning level is difficult and so appraisal cannot rely solely on baseline information.

Although the ODPM SEA guidance (2003) indicates how an SEA can form part of a Sustainability Appraisal by suggesting what types of effect could be considered beyond the scope of SEA (social and economic effects of a plan) but it does not provide any further details.

In relation to CEA, cumulative effects can only be assessed against the baseline relating to the valued resource. Thus, the draft framework was designed to integrate CEA into an SEA framework and adopts a baseline approach. The collection of baseline data is important because "*impacts can only be determined by comparing the situation before and after implementation*" and the identification of impacts is closely linked with a description of the environmental characteristics of an area (Wathern *et al*, 1987, p. 326).

In relation to objectives, they can also have a role in CEA within SEA. As Sheate (1996, p.171) argued, "*central to applying SEA should be clearly-defined objectives for*

[5] The Planning and Compulsory Purchase Act was passed by Parliament on the 13th May 2004.

the overall policy". These objectives can be qualitative statements or quantitative targets (Ibid, 1996). In CEA, environmental objectives could be set relating to a particular valued resource (e.g. objectives relating to the quality of landscape) and it could be used together with the baseline in determining significance and in proposing mitigation. This is in line with the 'integrationary' SEA model identified by Sheate *et al* (2001).

The design of the draft framework took into account the requirements of the SEA Directive and indicated where CEA fits into the SEA and planning processes. The proposed framework is indicative, rather than prescriptive, to encourage good practice. In addition, so that the framework can be useful as a planning and decision-making tool, it should be adaptable, effective, easy to understand and employ methods that planners and practitioners can readily apply.

Although there are cumulative social and economic effects, the focus of this research is on cumulative environmental effects. The draft framework therefore focuses on environmental impacts but includes social and economic impacts as a consequence of environmental ones.

In terms of the substantial element of the framework, it had to include features identified in CEA good practice: setting the baseline and thresholds for resources, taking a long-term, broad view of cumulative effects problems, analysing of cause and effect and adopting a collaborative approach. An essential point in CEA is gaining an early consensus among concerned agencies on the strategy for addressing concerns regarding valued resources (Williamson *et al*, 1993).

In the light of the literature review and interview survey, some problem areas in CEA were identified and these informed the content of the draft framework. The problem of understanding the concept, particularly cumulative effects at strategic levels was addressed by focusing on cumulative effects relating to one policy: urban regeneration. Most development plans have urban regeneration policies and sub-area urban regeneration plans. Urban regeneration plans usually consist of mixed use, multiple developments with related infrastructure, with potential effects that could be cumulative. These planned developments are implemented within a defined area and time period and would be appropriate in defining certain types of cumulative effects due to: space and time and space crowding. Thus, cumulative effects issues were explored

in Thames Gateway as a whole with specific cases providing examples of the types of cumulative effects that planners may need to address.

9.6. CEA Process Issues

In designing the framework, there were process issues that needed to be addressed. These will be discussed in the following sections.

9.6.1 Identifying valued resources and establishing the baseline

Since the focus of CEA is on valued resources, these should be identified early in the planning process, specifically during identification of issues. Some important resources are easily identified, such as designated nature conservation areas. Others may not be so obvious, such as an urban open space which may not be designated but of value to the community. Several approaches can be used to help identify these resources. For example, the SEA Directive requires consultations with agencies during scoping during which important resources and any cumulative effects problems could be identified. Furthermore, consultations undertaken during the preparation of the issues and options report in plan preparation could include cumulative effects issues relating to important resources. Another approach is the use of "characterisation" which describes the environmental, economic and social character of the plan area and indicating its key characteristics, could be used in identifying important resources in the area (Land Use Consultants *et al*, 2002). This approach was used in the Sustainability Appraisal of Cambridgeshire County Council and Peterborough City Council. Characterisation can be undertaken using available data such as state of environmental reports and other documents.

Once the valued resources are identified, the next step would be to establish the baseline condition and trends. At the plan level, baseline data may be difficult to obtain (Devuyst, 2000). State of the environment reports, carrying capacity studies and sustainability indicators can provide improved understanding of the changing baseline environment. For valued resources that are designated nature conservation areas (SSSIs, SPAs, SNCIs), it is likely that there is available data. English Nature and RSPB, for example, hold data on species and habitats. What may be more difficult may be to identify trends. In this case, indicators could be used to define the state of the resource and establish its condition in relation to a threshold. For example, data used in identifying indicators and targets in the Regional Sustainable Development Frameworks

(SEERA *et al*, 2001) or the indicators of sustainable development in Kent County Council's (KCC) Sustainability Action Plan (KCC, 2000) may be useful[6].

The SEA Directive requires consideration of environmental protection objectives and their relation to the plan. In terms of the CEA, these objectives are considered in relation to the valued resource.

9.6.2 Setting boundaries

The CEA literature suggests that different boundaries should be set for each cumulative effect (CEQ, 1997; Canter, 1999, US EPA, 1999). However, impact boundaries and administrative ones don't always match (Irwin and Rhodes, 1992). The draft framework addressed the issue that SEA is prepared for the geographical area covered by the plan but cumulative effects may go beyond its boundaries by suggesting a partnership approach. One of the guiding principles of the framework is that cumulative effects require a multi-agency approach.

9.6.3 Determining impact significance of effects

Determining significance of cumulative effects, involves regulatory, technical and public interests considerations. These include regulatory standards (for air and water quality). For protected areas, evaluation criteria developed by Ratcliffe (1977 in Spellerberg, 1992) can be used. Where there are no such measures, other approaches may be required. Capacity studies, already used in planning, could be used to determine the significance of additional impacts on the resource (see Chapter 5). Another method is the quality of life capital approach, which can be used in identifying the benefits relating to a particular resource since it looks at the attributes and services that the resource can provide (see Chapter 5). This method has been applied in relation to designated areas to see how the cumulative effects of individual decisions are affecting those areas. It helped inform the assessment by ensuring that all the important aspects of the designated area, secondary and indirect effects of the proposal were identified (Countryside Agency *et al*, 2001). This method can help identify the parameters for change relating to a valued resource since any changes in its attributes could affect the services that it could provide and determine measures for mitigation and enhancement.

[6] For example, other sources of information in Kent are: the Kent Red Data Book (KCC, 2000) and the Kent Wildlife Habitats Survey (1995).

9.7 The network analysis method

The interview survey identified the need for methods that planners can use in CEA and in designing the CEA framework the type of method that could be used was carefully considered. There are a variety of CEA methods, from simple ones to computer modelling (See Chapter 4 for a discussion of methods). But the appropriate method should be one that can be applied in strategic planning, particularly in considering policies, options and proposals. Methods in EIA that may have application in policy appraisal include matrices and flow diagrams (Wathern *et al*, 1987).

In addition, for CEA to become normative in SEA and be integrated within decision-making processes such as land use planning, practical methodologies must become available to the practitioner (Damman *et al*, 1995). In the context of SEA in Flanders, Devuyst *et al* (1998) suggested that methods should be as simple as possible because staff members of municipal authorities are often not qualified to do extensive scientific studies but could learn to apply simple methods such as checklists. The same situation could also be said in the UK, where the training of planners does not include in-depth scientific studies. In addition, the following factors: lack of data, the scale of the assessment and the number and nature of variables to consider qualitative methods point to qualitative methods. However, this does not preclude quantification methods for some detailed studies in the CEA.

The ODPM appears to take the same view and the SEA draft guidance[6] (2002a) suggests the use of matrices for assessing the cumulative and synergistic effects of the draft preferred options. SEA objectives are set out against short, medium and long term impacts of the preferred option for each issue and the cumulative effects are the combined impacts of these options. Matrices are largely used in sustainability appraisals and planners are used to this method. Matrices can be used to identify interactions, such as the environmental interaction matrix proposed by Leopold *et al* (1971 in Glasson *et al*, 1995).

However, matrices have limitations in CEA. For example, they do not show linkages between impacts or indicate indirect or higher order effects (Bisset, 1981). The limitations of checklists and matrices in the investigation of indirect effects has led to

[6] At the time the draft framework was being developed, only the SEA draft guidance (2000) was available. The final SEA guidance was issued on October 2003 and this was taken into account in the revision of the framework.

the development of a group of methods that explicitly recognise the systems characteristics of the environment (Morgan, 1998). Thus, matrices in combination with networks can be useful in impact identification and analysis (Sorensen, 1971; Wright and Green, 1987; Wathern *et al*, 1987).

Networks are based on a systems approach. Systems based approaches rely on a conceptual understanding of the environmental system and the processes that link different environmental components. There are two basic approaches in these systems-based methods (Shopley and Fuggle, 1994):

- Those that focus on the cause-effect linkage of the proposed action, which include networks, flow diagrams and stepped matrices;
- Those that focus on the nature of the environmental systems as the basis for the understanding of the interaction of the proposed projects with those systems, composed of systems diagrams and systems models.

Gilliland and Risser (1977) applied systems diagrams to the White Sands Missile Range EIS and found that its utility lies in guiding data collection; organising and summarising data; making interactions between the environment and the proposal; placing impacts and alternatives in perspective with each other and with the entire system and identifying components of the system which needed further analysis.

Network analysis methods have been used in the social and behavioural sciences as well as in economics, marketing and industrial engineering. Network analysis originally relied on graph theory (Phillips & Garcia-Diaz, 1981). The network perspective encompasses theories, models, and applications that are expressed in terms of relational concepts and processes. Thus, relations defined by linkages among units are a fundamental component of network theories. In the social sciences, the focus of social network analysis is on relationships, patterns and implications of these relationships (Wasserman and Faust, 1994).

Network analysis is based on the importance of relationships among interacting units. The strength of the approach is that it can be applied to almost any problem with enough knowledge and insight (Phillips and Garcia- Diaz, 1981). These authors suggested some advantages of using network models:

- Network models can accurately represent many real world systems;

- Network models seem to be more readily accepted by non-analysts. Since network models are often related to physical problems, they can be easily explained to people with little quantitative or scientific background.

The strength of an impact network is that it can extend the analysis of impacts. Impact networks combine the comprehensive groupings of activities and environmental elements provided by the impact matrix with the explicit tracing of higher order impacts in a cause-effect network (Julien *et al*, 1991). Network analysis methods are particularly useful in analysing cause-effect relationships and parallel chains of events (Lane *et al*, 1988; Cocklin *et al*, 1992b; Smit and Spaling, 1995; Canter, 1999; Hyder, 1999). In impact identification, networks allow checking compliance with regulations, trace secondary, indirect and cumulative impacts, compare alternative options, can use qualitative and quantitative information and are unbiased and consistent (Glasson *et al*, 1995). Thus, they can assist the practitioner in identifying potential pathways and relevant environmental impacts to guide the assessment.

Networks have been applied in a variety of situations. Networks have been used to analyse the effect of quarrying on adjacent vegetation (Sheate, 1986) and the effect of motorway development on woodland (Sheate and Taylor, 1989). In the context of social impact analysis, a social impact network was drawn from perceived impacts, which was used as a framework for selecting social factors and indicators for evaluating the social impacts of the Eastern Seaboard Development Programme in Thailand (Indhapanya *et al*, 1999).

In CEA, networks have been used to analyse cumulative effects of large projects such as a waste treatment facility, regional airport and hydroelectric dams (Lawrence, 1994; Testoni, 2002; Brismar, 2004). At strategic level, network analysis has been applied to:

- identify causal factors and consequences due to multiple use of the coastal zone (Sorensen, 1971);
- understand the problems that influence environmental quality and how the problems are related to other problems in Cheasapeake Bay (Williamson *et al*, 1987);
- assess the cumulative effects of uranium mines in Saskatchewan (Ecologistics Ltd, 1992);

- analyse the impact of development in the coastal zone in Australia (Court *et al*, 1994) using a modified form based on the method developed by Lane *et al* (1988).

In the Cheasepeake Bay restoration plan, workshop participants identified important cause-effect relationships and problems were examined through these networks. Williamson *et al* (1987, p. 387) found that the cause-effect diagram format was useful in presenting complex information than in text and it was a *"valuable organizer of group thinking, an easy way to obtain understanding and general acceptance, and a comprehensive method for identifying specific restoration tasks"*.

Networks are *"workable methods with practical application to local and regional planners and decision makers"* (Dixon and Montz, 1995, p. 455). Indeed, a model developed to evaluate CEA for protected areas required the development of cause-effect diagrams (Mendoza *et al*, 2000).

Extended and computer based impact networks have also been developed (Thor *et al*, 1978; Julien *et al*, 1991). In a survey of CEA practice in the US and internationally, however, Burris and Canter (1997) found that the majority of methods that have been used have been traditional methods such as checklists and network diagrams. They suggested that these methods might be popular because practitioners feel comfortable using them rather than computer models, which incorporate assumptions and quantitative results with which they may be unfamiliar.

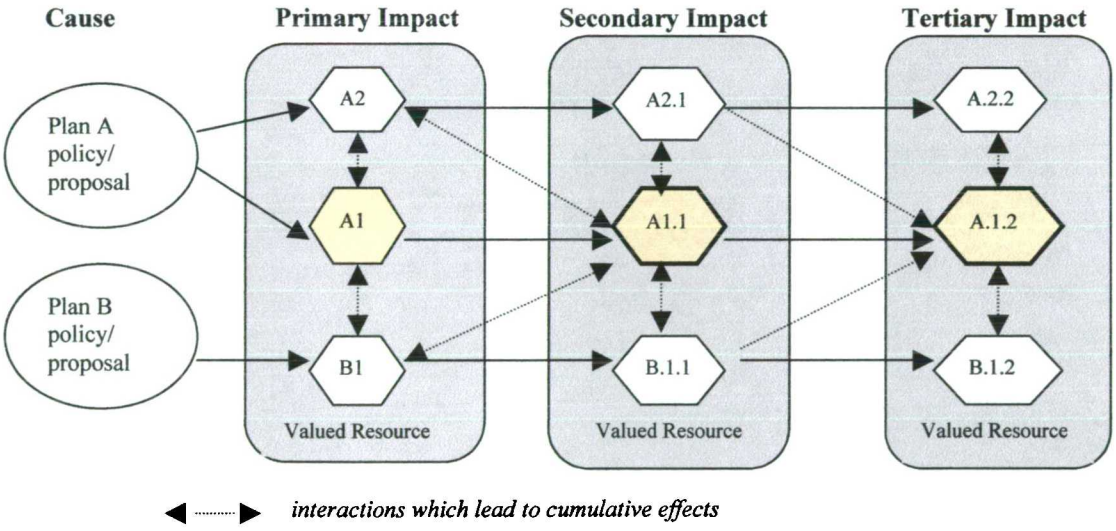
Networks trace the linkages between the directly affected environmental resource and other components of the environment. They can chart the main consequences of the action and higher order effects. A thorough analysis and understanding of potential impact pathways and key cause-effect relationships is essential for the identification of measures to mitigate cumulative impacts (Brismar, 2004). More specifically, networks can assist the practitioner in determining what impacts should be looked at in more detail and ensure that higher order impacts are not overlooked. Although networks are qualitative, it may be possible to include quantitative measurements in the diagram if there are appropriate data available.

In the context of strategic planning, network analysis can chart cumulative impacts, which could occur through the following ways:

- interactions between policies and proposals of one plan and the policies and proposals of another plan affecting the same valued resource;
- interactions between different policies in a plan affecting the same resource;
- interactions between different proposals in a plan affecting the same resource;

These CEA considerations in strategic planning are illustrated in Figure 9.4. CEA is particularly useful in comparing alternative options, where higher order impacts are not immediately apparent and in analysing 'nibbling' effects from policies or proposals. In strategic CEA the root causes of potential impacts are policies and proposals of the plan and the analysis involves tracing their impact pathways.

Figure 9.4 Network analysis to chart impact linkages



As shown in Figure 9.4, cumulative impacts can result from interactions of impacts from different policies or proposals: primary, secondary and tertiary impacts. These effects become significant when the effects are considerable or when a threshold for the valued resource is reached. For example, the effects that are likely to be more significant are (A1.1 and A1.2). For example, Plan A has an urban regeneration policy to redevelop an area and proposals to build more housing and offices while Transport Plan B has proposals to extend the railway system in the same area. These proposals could result in loss of open space and vegetation (A1, A2 and B1) in the area. A secondary effect (A.1.1) may be loss of access and loss of nesting and feeding areas for terrestrial animals and a tertiary effect (A.1.2) may be reduction in animal numbers.

9.8 Summary

This chapter presented how the CEA framework was developed. It discussed how issues in CEA practice identified in the literature review and interview survey were addressed in the proposed CEA framework. An overview of the network analysis method and the rationale for choosing the method were presented. The next step was to apply the Framework and the network analysis method to sub-case studies and the results are discussed in the following chapter (Chapter 10).

Chapter 10. Applying the Framework

10.1 Introduction

The case study method was used to refine the draft framework. The case study is a favoured strategy in planning processes and is the preferred method when a *'how* ' question is being asked about a contemporary set of events over which the researcher has little or no control (Yin, 1994). In this case, the question was:

How were cumulative effects issues addressed in planning?

This involved analysing case study approaches and processes of real planning situations and applying the proposed framework against them. Furthermore, the types, nature and extent of cumulative effects in these cases were explored while testing the network analysis method.

Yin (1994) identified four types of case study designs. The case study design chosen for the analysis was type 2 – single case design with embedded multiple units of analysis. *"The subunits can often add significant opportunities for extensive analysis, enhancing insights into the single case"* (Yin, 1994, p.44). In this case, the Thames Gateway provided the context for exploring cumulative impacts issues resulting from urban regeneration policy and proposals (see Chapter 8).

The subunits consisted of four cases to which the draft framework was applied. These cases represented different planning levels: local, area-wide and sub-regional. Each case had something different in terms of approach and by testing on these cases in depth information and interviews to explore how other approaches might have worked (or would work in the future), is embodied in the overall CEA framework.

10.2 Selection of sub-case studies

The criteria for selecting sub-case studies were:

- a plan or strategy for the area has been completed or has reached an advanced stage;
- multiple developments in the area;
- cases representing different types and scales of cumulative effects issues
- cases representing various approaches adopted by planning authorities;
- the presence of valued resources in the case study area, such as protected areas likely to be affected;

- cases should represent a number of others and are typical in some way;
- availability of SEA/CEA/EISs and environmental reports;
- willingness of those involved to provide information and respond to inquiries.

10.3 Selected case studies

Potential case studies considered included urban regeneration schemes and other plans to address cumulative impacts in the Thames Gateway area. Table 10.1 lists the case studies selected and the corresponding selection criteria, indicating how these were met.

Table 10.1 Case studies selected

Case study	Responsibility	progress	approach	scale	VEC	c. i. Issues
Millennium Quarter Plan	Tower Hamlets Council	completed and under implementation	CIS	local	human/urban	noise transport
Creekside area/West Greenwich development framework	Greenwich Council and Lewisham Council	completed and under implementation	planning framework, development control and EIAs	area covers parts of two local authority areas	Deptford Creek human/urban	ecology transport
Ebbsfleet development and environment framework	Dartford Council and Gravesham Council	completed and under implementation	planning framework, development control and EIAs	area covers parts of two local authority areas	human/urban Ebbsfleet river landscape	Transport ecology
Thames Estuary Flood Risk Management Plan	Environment Agency	Initial strategy and scoping completed; baseline studies on-going to be completed 2008	CEA in SEA	Sub-regional	human/urban flood plain SSSIs and SPAs	flooding

CIS: Cumulative Impact Study c.i. : cumulative impact

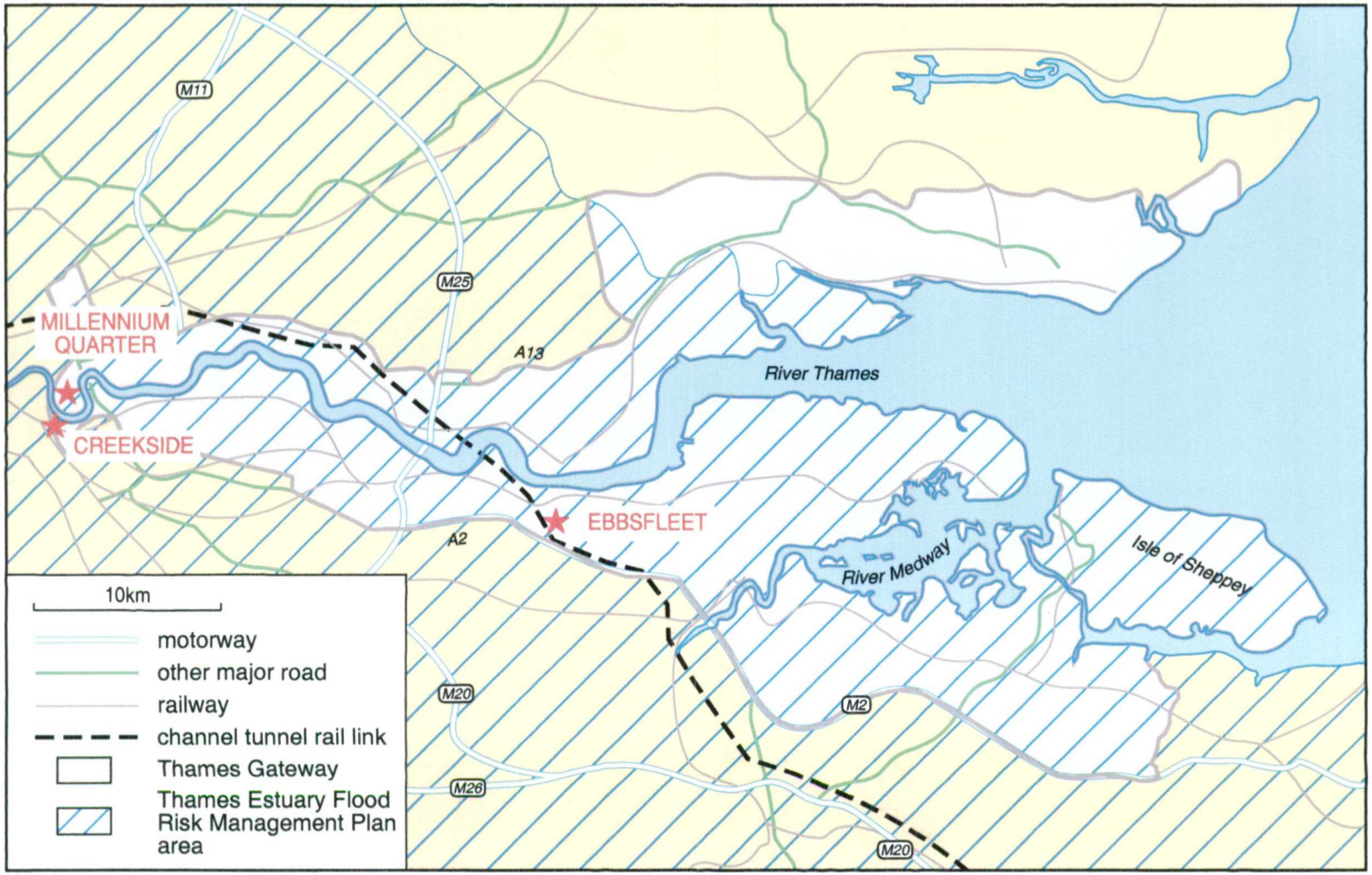
Other potential case studies that were rejected are listed in Table 10.2. In addition, urban regeneration schemes in other areas, which were at a more advanced stage than those in the Thames Gateway, were investigated to have a better insight into cumulative effects issues in urban regeneration. These included the Paddington Basin Regeneration; Bankside Regeneration in Southwark & Lambeth; and Kings Cross Regeneration. Documents relating to these schemes were examined and relevant seminars and conferences attended.

Table 10.2 Potential case studies and reasons for rejection

Royal Docks, Excel Exhibition Centre and Silvertown, Newham	Data needed were inaccessible; although staff in the environmental health office and the consultant were helpful, some staff in the local authority were unwilling to contribute
The Dome and Millennium Village, Greenwich Peninsula	At the time of selecting cases, there was uncertainty as to what would happen to the Dome and the Millennium Village development was just starting. Since then, an EIS has been prepared for the Dome.
Woolwich Arsenal, Greenwich	Although there was an EIS available, it was not a very substantial document.
Chatham Maritime developments, Kent	EIS or environmental report not available.
Rochester Riverside, Kent	Negotiations regarding proposal for development on-going and so at a sensitive stage with confidentiality involved.
Basildon Developments, Essex	Not enough data available.
Canvey Island Developments, Essex	Case little advanced at the time of selecting cases
Shell Haven Port and Related Developments, Tilbury, Essex	EIS still being prepared at the time cases were being selected.
Havering Riverside	Large housing and commercial development proposal but in early stage of planning

The location of the selected cases is shown in Map 10.1. The cases cover three planning scales: local, area-wide (covering parts of two local authorities) and sub-regional (covering part of the Thames Gateway along the Estuary). The case studies represent different types of cumulative effects. Three case studies are urban regeneration/development schemes while the Thames Estuary Flood Risk Management (TEFRM) Plan is a management plan addressing a potential cumulative effect (flooding) due to regeneration developments in the area. The application of the framework to the TEFRM has tests its usefulness in another type of plan other than land use plans.

Two of the cases involved CEA studies: the Millennium Quarter CEA study and the Environment Agency's TEFRM Plan where a Cumulative Environmental Appraisal (CEAp) is undertaken as part of the SEA. These cases involved cumulative effects issues: noise and transport (Millennium Quarter CEA) and flooding (TEFRM Plan).



Map 10.1 Location of Case Studies

The other two case studies involve urban regeneration schemes covering parts of two local authority areas: Creekside area (London Boroughs of Greenwich and Lewisham) and Ebbsfleet valley (Dartford and Gravesham). In each case, an area development framework has been formulated in partnership between the relevant authorities to address potential impacts from developments. Although the Ebbsfleet Environment and Development Framework identified potential cumulative effects that needed consideration, both cases adopted a mainly development control approach, addressing cumulative effects through the development control and EIA processes. The aims of the case study research, methods and information used relating to the case studies are contained in Appendix 6.

10.4 Case study methodology

The research methodology employed in the sub-case studies consisted with initial discussions with planning officers and officials from agencies with responsibilities in the Thames Gateway and the examination and analysis of relevant reports. This was followed by semi-structured interviews with participants in the planning process (planners, developers, consultants and environmental NGO officers) in each case study area.

10.4.1 Documentary analysis

Planning documents were reviewed to understand government, regional and local authority policy. In analysing documentary evidence, inductive methods were used to arrive at a set of generalisations about planning approaches and processes. Documents examined include those listed in Box 10.1. A list of documents reviewed relating to each case study is included in the Appendix 6.

Cumulative effects issues were identified from documents such as planning frameworks, UDPs or local development plans, environmental studies, EIAs and committee reports. Observations of selected cases through field visits were used to supplement documentary evidence. These methods were employed in order to develop theories or hypotheses regarding cumulative environmental issues.

10.4.2 Consultations

The documentary evidence on the cases was supplemented by information from consultations with participants in the planning process (See Table 10.3). Semi-

structured interviews (mostly in person and a few by telephone) were conducted to discuss the process for considering cumulative effects and cumulative effects issues. The consultations served to improve objectivity, verify information and attain triangulation. Interview questions are listed in Appendix 6. Although these questions formed the basis of the interview, further questions were asked on specific aspects relating to the particular case study and approach. In addition, draft network diagrams were shown to some interviewees (planners and environmental officers) for their comments on: i) the impacts and ii) the method.

Table 10.3 List of interviewees for case studies

Case study/interviewee	Position
Millennium Quarter	
Paul Iliffe	Planning Officer (development control) case officer
Eno Amooquaye	Planning Officer (policy and plans)
Alan Hawes	Environmental Health Manager
John Towner	Consultant who prepared CI Study
Julian Carter	Planning agent for Ballymore Properties (one of the developers
Deptford Creek area	
Christian Robinson	Planning Officer (development control) Greenwich – case officer
Leon Yates	Planning Officer (regeneration) Lewisham - involved in design and policy for the area
Jill Goddard	Nature Conservation Officer – Lewisham and project manager for the Creek Environment Project
Chris Gitner	Deptford Creek Education Trust Officer and member of the Ecology Group
Toni Scarr	Conservation Officer, Environment Agency
Ebbsfleet Area	
Sandra Bunn	Planning Officer (development control) and case officer - Dartford
Sian Phillips	Planning Officer (strategic planning) Dartford
Peter Price	Planning Officer (development control) and case officer - Gravesham
Tony Chadwick	Senior Planner - Gravesham and project leader of Implementation Group for Kent for Thameside
Thames Estuary Flood Risk Management Plan	
Sarah Lavery	Project manager
Rachael Hill	Habitats and planning strategist
Kevin House	SEA Officer
Rob Cameron	Deputy manager - English Nature Kent Team

In addition to the interview survey, discussions with other individuals and representatives from local organisations in the case studies from the case study areas were undertaken. Seminars organised by the Thames Estuary Partnership Forums and British Urban Regeneration Associations were attended. Overall, these methods provided extensive information on the case studies.

10.5 Themes of case study application: approach, process and network analysis

The application of the Framework to the case studies involved analysis of approaches, processes and the testing of the network analysis method. The case studies were analysed in terms of:

- the effectiveness of their overall approach against the CEA approach set out in the framework
- the process used for addressing cumulative effects as compared to the CEA process outlined in the draft CEA framework

The approaches of the planning authorities for addressing cumulative effects were defined from examining documents (CEAs and EIAs, UDPs, appraisals and committee reports) and from interviews. Criteria derived from the draft framework were used to evaluate the approaches. These are set out in Box 10.1.

Box 10.1 Criteria for analysing the effectiveness of approaches in the case studies for addressing cumulative effects

- Were there clear environmental policy objectives that included cumulative effects?
- Were there guiding principles and did these include cumulative effects considerations?
- Was the assessment process integrated into the plan-making process?
- Was there a commitment to identify cumulative impacts from the local authority? From other stakeholders?
- Were multiple organisations involved in addressing the effects?
- Did the process lead to a better understanding of cumulative effects among those involved in the process?
- Did the consideration of cumulative effects provide a useful input to strategic planning?
- Did it make a positive contribution to decision-making and development control process?

Although the draft framework was designed to incorporate CEA into the SEA process in plan-making, the proposed CEA process was compared to actual planning processes in the case studies in order to assess how those approaches might be improved. Criteria for evaluating the case study process were derived from the draft framework in order to systematically review relevant documents and these are listed in Box 10.2.

Box 10. 2 Criteria for evaluating case study processes for considering cumulative effects

- **Scoping:**
  - Were cumulative effects issues of concern identified?
  - Were valued environmental components identified?
  - Were spatial and temporal boundaries set appropriately?
  - Were potential significant impacts identified?
  - Were other actions affecting the environment identified?
- **Baseline conditions:**
  - Were baseline conditions established for valued resources?
  - Were thresholds identified for valued resources?
- **Assessment of effects:**
  - Were the causes, pathways and potential impacts and the relationships of impacts defined?

Were cumulative impacts identified?
Was the significance of cumulative effects determined?
What criteria or standards were used to determine significance?

- **Mitigation**:
  Were alternatives to mitigate cumulative impacts considered?
  Were mitigation measures proposed specifically for cumulative effects?
- **Monitoring**:
  Did monitoring proposals include cumulative effects?
- **Consultations:**
  Did the consultations include cumulative effects issues?

Network analysis was used to identify causes, pathways and effects and impact relationships that could lead to potential cumulative effects. Network diagrams were prepared at a strategic level for each case and more detailed ones focused on particular impacts, such as noise, ecology and transport.

Finally, the proposed CEA Framework was applied to each of the case studies to identify any improvements and where these were likely to be, if the Framework had been used. Criteria by which improvements to the traditional analyses were judged included: relevance to decision-making, effectiveness and efficiency. Relevance for decision-making involves ascertaining usefulness of the Framework for decisions made at various stages of the planning process. Sadler (1996) identified key issues in determining relevance, which were modified for this study: i) the CEA framework facilitates and results in informed choices and ii) the information derived from the CEA is timely, relevant and focused on the issues. CEA can therefore facilitate decision-making by providing a well-structured analysis of effects of the proposed plan.

Effectiveness can be achieved if the analysis: conforms to established principles in CEA; set clear objectives; assesses impacts early in the planning process; applies a systematic procedure; establishes adequate scope by including all relevant issues and factors; uses appropriate methods for CEA; results in the satisfactory prediction of adverse effects of the proposed plan and serves as an adaptive and organising process where the results are fed back into the planning process.

Efficiency is judged by the outcome (assessment of cumulative effects), which is achieved at least cost and minimum time possible. The case studies and application of the proposed Framework are discussed in the following sections. Further information on the case studies and sources of information are contained in Appendix 6.

10.6 Case study 1: Millennium Quarter, Isle of Dogs, Tower Hamlets

Background

In March 1999, the London Borough of Tower Hamlets (LBTH) Council approved the Isle of Dogs Planning and Regeneration Framework, which established a broad strategy for the future of the Isle of Dogs. This Regeneration Framework identified a number of areas for which Master Plans should be prepared, including the Millennium Quarter (MQ). The MQ covers an area of some 20 hectares.

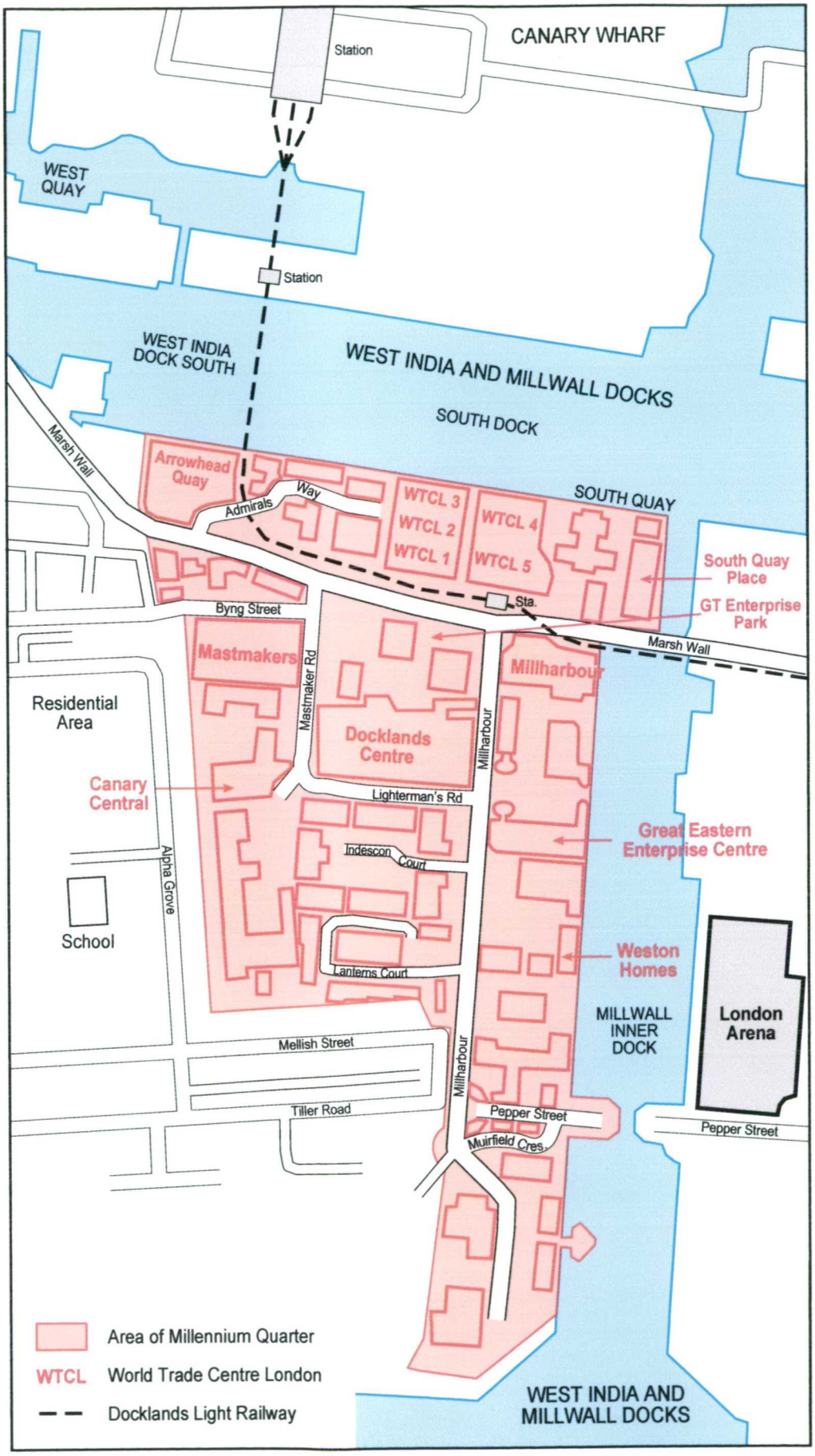
Millennium Quarter Master Plan

A Master Plan was commissioned in late 1999, with inputs from the Council, consultants and developers and involved extensive public consultations. The Policy and Implementation Committee approved the Master Plan on September 2000 as Interim Policy, to be incorporated into the Adopted Unitary Development Plan. The Master Plan is a planning framework document that contained a number of principles to guide development proposals and the design of schemes. A transport model was developed for the Master Plan, which was later updated (Arup et al, 2001). Map 10.2 shows the Millennium Quarter area.

The issues

As of 1999, planning applications to develop sites in the area have been received. The issues surrounding the developments in the area include the following (Stanger Science and Environment, 2001):

- the developments proposed are large, separate and many comprise multi-storey buildings;
- the developments are confined to a limited space in a built up area;
- there is no co-ordinating body to oversee the development and providing a single point of contact for the Council;
- close to the site are residential properties occupied by the indigenous population of the Borough who are not well disposed to these developments;
- those residents have been affected by major construction works at the north end of the Isle of Dogs for over 15 years (i.e. Canary Wharf developments).



Map 10.2 Millennium Quarter *Source: Modified from Environ (2001)*

There were some issues of concern expressed by local residents[1]:

- a large number of problems in the Isle of Dogs stem from past/continued building and high density developments;
- the infrastructure of the Island has not kept pace with the developments;
- congestion, pollution and public transport problems were related to the building works;
- current transport is not sufficient for the new developments. Particular concern was expressed regarding the unreliability of bus services and the overstretched services of the Docklands Light Railway (DLR).

10.6.1 Tower Hamlets Council's approach

Over the last twenty years, there has been significant and sustained development and large-scale construction work on the Isle of Dogs, such as the Canary Wharf Developments. The Council therefore has substantial experience of the cumulative impacts of construction activities. The Council's main concern relates to the cumulative impacts of substantial developments being built in close proximity to residential and commercial areas. Figure 10.1 outlines the context and the CEA approach adopted by the Council. To address potential cumulative impacts, the Council therefore took the following steps:

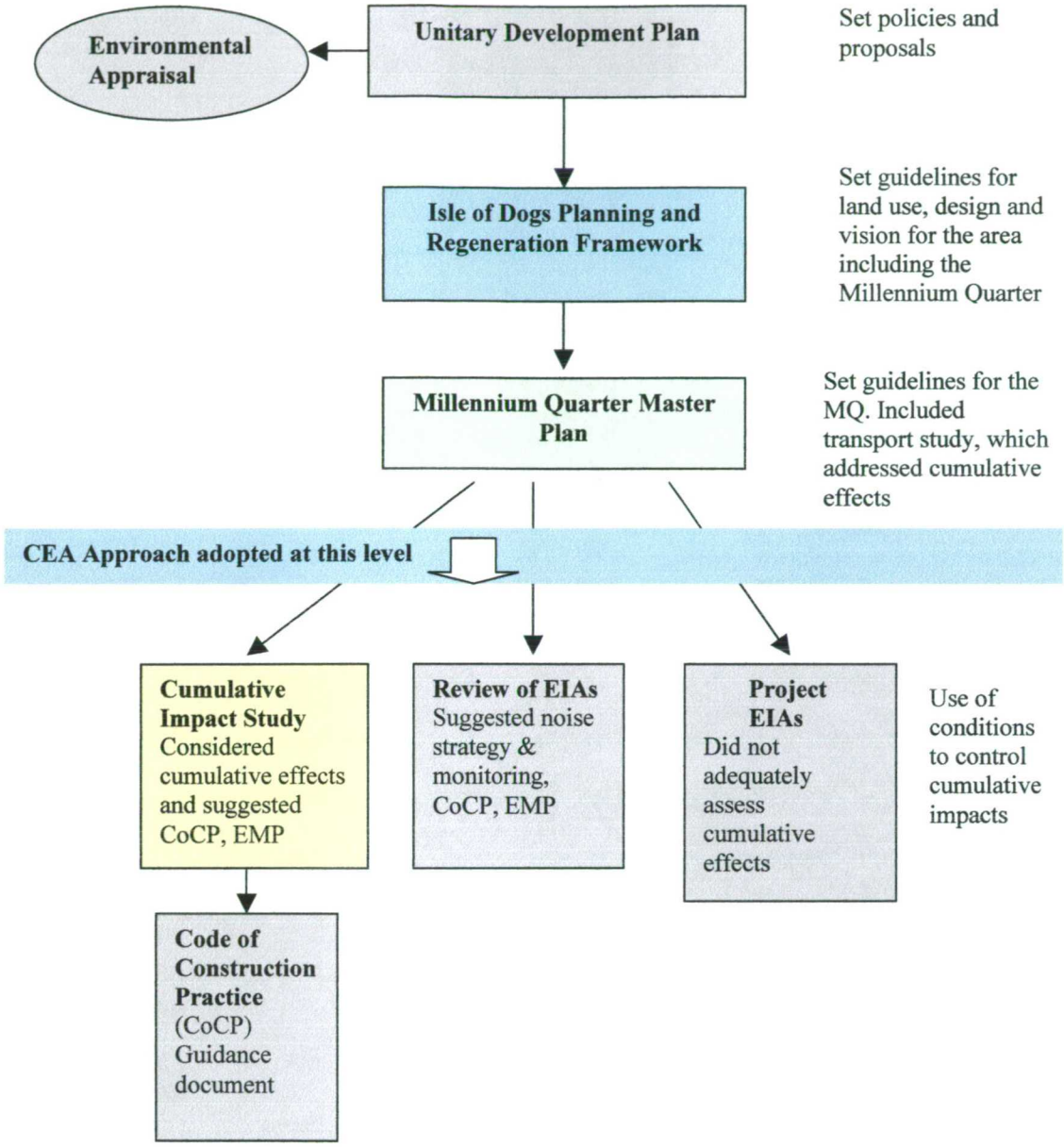
i) commissioned a review of the EIAs that had been submitted and an overview of impacts associated with the proposed developments including cumulative effects - Review of the EIAs was carried out (Stanger Science & Environment, March 2001);

ii) requested further information with respect to the potential cumulative impacts of five proposed developments - a Cumulative Impact Study (CIS) (Environ, May 2001);

iii) drafted a Code of Construction Practice (LBTH, 2001) to minimise impacts.

[1] Minutes of the Millwall Local Area Partnership Meeting on 8 April 2002.

Figure 10.1 Planning Context: Tower Hamlets Council's CEA Approach



Review of EIAs for the Millenium Quarter

The Council's Environmental Health Manager commissioned a Review of Environmental Impact Assessments because of concern over the potential cumulative noise impacts from construction activities. A key finding of the review was that the individual impact statements did not adequately consider cumulative impacts and suggested further studies, the use of planning conditions to control impacts, the preparation of environmental management plans and a noise framework strategy (Stanger Science and Environment, 2001).

The Cumulative Impact Study

The Cumulative Impact Study[2] (Environ, 2001) was undertaken to:

- identify potential cumulative environmental impacts of developments;
- predict the extent and significance of potential cumulative impacts and propose mitigation measures;
- identify the extent and significance of residual impacts

The CIS was based on the information from the individual EISs of the six proposals submitted to the Council and the report on the transport model undertaken by Arup Consulting (2001). The proposals considered are listed in Table 10.4. It should be noted that the CIS only considered those five proposals although there were other proposed developments in the Millennium Quarter and the Isle of Dogs.

Table 10.4 Proposed developments considered in the CIS

Development and site area	Type of use	Scale	Construction and period
Arrowhead Quay (0.6 ha)	Mixed commercial: offices, local retail, leisure facilities and open spaces	Two buildings 26 storeys	Demolish current car park site and construct buildings 3 years
WTCL 1,2 & 3 (0.72 ha)	Hotel, flats, offices, retail, restaurant and leisure	Three buildings: 14, 15 and 16floors	Alterations and extensions to three existing bldgs: 9, 12 and 19 floors
WTCL 4 & 5 (0.58 ha)	Offices, retail and landscaped open plaza WTCL 4: new office building with retail on ground floor WTCL 5: hotel and apartments	Two linked buildings 24 storeys	Demolish bomb-damaged buildings and construct new buildings 3 years
4 Mastmaker Rd	Offices	Two linked blocks of 11 and 13 storeys	Demolish existing warehouse on site and construct new buildings 2 years
1 Millharbour	Mixed commercial,	Two buildings: 25	Demolish bomb damaged building

[2] The study was entitled "Cumulative Impact Study" and is referred to in the thesis as Millennium Quarter CIS. Other studies use the term Cumulative Effects Assessment (CEA) which is more commonly used in the literature. The terms are considered here to be interchangeable.

	mostly offices with retail	and 9 storeys	and construct new buildings
Docklands Centre (1.2 ha)	Hotel, apartments, offices and commercial development	Three buildings: Bldg 1: 17-21floors Bldg 2: 11-15floors Hub building: 3 floors	Demolish Guardian Press Centre building and construct buildings 7 years (2001-2008)

Sources: Environ (2001); Individual EISs for the above developments; Tower Hamlets website for updates

The CIS identified types of cumulative effects, which could result from these proposed developments and these are set out in Table 10.5.

Table 10.5 Types of cumulative impacts

Type of impact	Issue
Additive	Archaeology and Cultural Heritage Ecology Shadow Soil Conditions and Contamination
Synergistic	Traffic and Transport Air Quality Noise (Construction and Traffic) Water Resources Television and Radio Reception
Neutralising	Townscape and Views Wind

Source: Environ (2001)

The CIS revealed that the effects of the developments (Arrowhead Quay, WTCL (1-5) and Docklands Centre) are likely to interact. Predicted levels at receptors close to the Docklands Centre site boundaries range from 86 to 89 dBA, which would occur during piling, which was considered the noisiest activity. Noise predictions were not available for some of the developments (WTC 4 & 5) and so only qualitative considerations were carried out. The CIS noted that concurrent works at the Docklands Centre site and 1 Millharbour could potentially result in cumulative impacts in the area east of the Docklands Centre site. Overall high noise levels may be experienced particularly if the noisiest activities (i.e. demolition and piling) were undertaken simultaneously.

Construction noise emissions from WCTL 4 & 5 could also potentially result in cumulative impacts north of 1 Millharbour. But as the authors observed, ***"properties in this area are already exposed to high traffic noise levels on Marsh Wall and noise from the DLR, thus the contribution of construction works to the noise environment is likely to be less significant"*** (Environ, 2001b, p.43). The CIS's main recommendation was that a Code of Construction Practice should be implemented and environmental management plans for each of the developments prepared. It should be noted that the CIS failed to consider noise impacts from other activities in the area and

that most of the EISs and the CIS were prepared by the developers' Consultants and so may be biased.

Code of Construction Practice

One useful output from the above studies was the preparation of a Code of Construction Practice (CoCP) which sets out a framework for the control of '*significant identified construction phase environmental impacts associated with all the proposed developments within the area designated the Millennium Quarter*' (LBTH, 2001, p.2). Its principal purpose is to ensure that the cumulative environmental impacts of the construction phase of the MQ development are minimised.

10.6.2 Evaluating the Effectiveness of the Council's approach

The approach adopted by the Council for addressing cumulative effects was evaluated against the criteria outlined in Box 10.1 and the results are shown in Table 10.6.

Table 10.6 Application of the draft framework approach to Millennium Quarter

Criteria	Tower Hamlets Council's approach
Clear objectives and guiding principles	UDP policies, key issues paper state that the environmental impacts of major developments are fully assessed. The CIS objectives were clear: to identify potential cumulative impacts of the developments, predict their significance, identify mitigation measures and identify the extent and significance of residual cumulative impacts.
Integration into the plan-making process	The Isle of Dogs Planning Framework and the Millennium Quarter Master Plan referred to potential environmental impacts but were not subject to appraisal. The CIS was undertaken during the development control process as a result of the Council's concern over potential impacts resulting from proposals. Its purpose was to assist the decision-making process, whether to grant planning permission. It was therefore reactive rather than proactive.
Commitment	The Council commissioned studies and tried to control cumulative construction impacts through a legally binding CoCP, embodied within a planning obligation.
Multiple organisation involvement	Involved in CIS were limited to the Council, the developers, their agents and EIA consultants. Other organisations involved in the mitigation measures as part of the planning permission process. For example, legal agreements with the Docklands Light Railway had to be drawn up before planning permission was granted. The Isle of Dogs Community Foundation, which manages SRB funds for the area will manage the funds set up from the Millennium Quarter developments for the improvement of community facilities, training and other related activities.
Better understanding of cumulative effects	Construction impacts usually considered short-term but in these circumstances, they are long-term. The approach also highlighted the limitations of addressing cumulative effects at the development control process alone.
Input to strategic planning	CoCP used as guidance by developers and for future developments.

	Transport Model developed used in EIA for another development in the Thames Gateway.
Contribution to decision-making	The CIS helped secure planning permission for the developments. It also created more awareness of cumulative issues and assisted the Planning Authority in considering subsequent applications.

The UDP recognises that "*Tower Hamlets is a densely developed inner urban area in which few development sites are far from large concentrations. The environmental implications of large developments can have a significant impact on the quality of life for a large numbers of residents*" (LBTH, 1998, p.64). Policies formulated to address such impacts are contained in Appendix 6.

There was a commitment from the Council to address potential cumulative effects. The scoping reports in the ESs submitted showed that the Environmental Health Manager (EHM) specified that cumulative effects should be considered in the EIAs. The Council tried to enforce the CoCP as a planning obligation to control construction impacts, particularly noise but was unsuccessful. In August 2001, a planning applicant (Weston Homes plc) appealed against the Council for failure to grant planning permission within the prescribed period. The applicant was not one of those who commissioned the CIS and CoCP and did not wish to comply with a legally binding CoCP within a planning obligation. The Secretary of State granted planning permission to Weston Homes on the 23rd May 2002, following the Inspector's recommendations that the appeal be allowed and planning permission granted subject to conditions. The Inspector concluded that '*any harmful effects arising from the construction phase of the appeal scheme could be addressed by means of planning conditions and the powers conferred on the Council by the Control of Pollution Act 1974 and other legislation which could be used effectively to control such effects, both individually and cumulatively*' and that the proposed contractually binding code of construction was unnecessary (GOL, 2002). What this judgement implies therefore is that cumulative effects can be addressed by planning conditions. Controlling cumulative effects in this manner is not always effective because monitoring of compliance to conditions is not often undertaken (Dipper *et al*, 1998).

The planning officer and EHM were both concerned about the cumulative effects of construction works from the developments. Construction impacts are considered usually considered short term. But as the EHM pointed out, construction of these

developments are actually long term because of the scale of these developments and the fact that the area has been subject to construction impacts for the past 15 years, with the construction of Canary Wharf and related developments.

An important lesson in this case study is the lack of effectiveness of existing planning tools to address these issues. The Planning Officer (development control) noted that project EIAs do not address cumulative effects adequately. The EHM commented on the limitations of current planning tools and legislation for addressing these effects. The Control of Pollution Act 1974 (Sections 60 and 61) are concerned solely with noise and not intended to control other impacts such as dust, air quality or traffic. From the Council's experience, their attempts to regulate these other matters under Section 61 were unsuccessful (Ibid, 2002). Furthermore, sections 60 and 61 relate to specific sites and were not designed to deal with cumulative effects over a wider area, apart from noise abatement zones. Another piece of legislation is the Environmental Protection Act of 1990, which controls statutory nuisance under section 79. However, this makes no provision for dealing with cumulative construction impacts. The above legislative controls are reactive in their approach, unlike the CoCP, which was proactive in trying to minimise impacts.

The consultant listed the following constraints to the CIS: the different approaches and methods used in the EIAs and the timing of developments as limitations in assessing cumulative effects. Although the CIS led to the formulation of the CoCP, this was not acceptable to other developers who were not involved in its preparation. It should be noted that the developer's agent and consultant found the CoCP too prescriptive.

However, there are positive contributions from the Council's approach. The consultant who prepared the CIS observed that the study created more awareness of the cumulative impact issues among developers and a better understanding of each other's requirements, for example in the construction phase. The Planning Officer of the Millennium Quarter Team concluded that the CIS resulted in the drafting of the Code of Construction Practice, which is now being used as guidance by the developers and will be used in future developments in the MQ.

An important input of the Council's approach is the contribution of the Millennium Quarter Master Plan Transport (MQMPT) Study to strategic planning. It has been used

in another EIA for a large development in the Thames Gateway, the redevelopment of Convoy's Wharf in Deptford, Lewisham. The transport model and assumptions on increase in transport demands developed by the Convoy's Wharf study (Land Use Consultants, 2002) were based on the MQMPT study. In anticipation of future developments in the Thames Gateway, other local authority officers[3] in the area commented that they are closely watching how the LBTH deal with cumulative effects.

The interviewees suggested measures for addressing cumulative effects at strategic level. The Planning Officer (development control) suggested that the Master Plan level might be an appropriate strategic level to address these effects. The developer's agent suggested that cumulative effects could be considered at the Planning Framework level, early in the process, when an area is identified for regeneration. According to the EIA Consultant, an appropriate level for addressing cumulative effects would be at the scoping stage of a strategic assessment. The assessment should be undertaken by the local authority, which would allow the local authority to identify how to deal with multiple developments. Parameters to assess should then be set out for project EIAs. He also suggested that the key to addressing cumulative effects is to start earlier, possibly at policy level. In terms of features of the CEA, the developer's agent suggested that it should be practical and adopted as supplementary planning guidance while the consultant identified the need for more rigorous methods.

10.6.3 Discussion of CEA approach

The Council's CEA approach was useful in that it led to a better understanding of cumulative impacts of urban regeneration schemes among the key players: noise, transport, dust and air quality impacts. However, conducting a CEA approach during the planning application phase has its disadvantages. For a start, EIAs would have benefited if guidance or parameters had been set beforehand, as the Consultant suggested. For example, the Isle of Dogs Planning and Regeneration Framework (LBTH, 1999) refer to the Canary Wharf Developments where the London Docklands Development Corporation set noise limits for the Enterprise Zone.

Another problem with addressing cumulative effects at the development control stage is that the tools available for doing so are limited to setting conditions. For example, in

[3] These planning and environmental health officers (Gavin Thorne and Robin Whitehouse, Newham Council) were contacted initially to identify potential case studies.

the Weston Homes development, the Secretary of State imposed a condition that "*the level of noise emitted from the site when taken in conjunction with noise from other sites within the area shall not exceed 75 dBL $A_{eq\ 10hour}$ at 1 metre in front of any façade of any occupied building unless otherwise agreed in writing by the local planning authority*" (GOL, 2002). One problem with this approach is that when there are several developments under construction, it may be difficult to attribute noise impacts to particular developments.

The interviewees suggested that cumulative effects could be considered at strategic levels: policy, framework or master plan levels. In this context, the UDP Planning Policy T15 (LBTH, 1998) requires proposals to be assessed in relation to the ability of the transport system to accommodate the additional traffic to be generated in the area. However, the Environmental Appraisal of the UDP (2002) did not refer to cumulative effects. With the current review of the UDP, it would be useful if the cumulative effects of policies and proposals were assessed in any future appraisal of the plan.

The Isle of Dogs Planning and Regeneration Framework (LBTH, 1999) stated that its fundamental objective was to ensure the sustainable regeneration of the island and sets out its strategy for the area. It provides guidelines on land use, design, transport and other matters but did not address cumulative effects.

Similarly, the MQ Master Plan set out general principles and design guidelines for the area. It provided guidelines for the scales of the developments, uses and built form and listed planning and environmental considerations. Apart from the Transport Study, it did not go into detail regarding other environmental impacts.

It would be useful if the experience from the approach could inform future revisions of the planning frameworks for the area. Referring to Figure 10.1, CEA should take place during the SEA of the UDP, when policies and options are being developed and the cumulative impacts of regeneration policy can be considered. CEA can also be undertaken during the preparation of SEA of Area Plans, such as the Isle of Dogs Planning and Regeneration Framework where the overall impacts of developments can be better addressed.

10.6.4 Evaluation of the CIS Process

The process adopted for the CIS was evaluated against the CEA process in the draft framework. The results are shown in Table 10.7.

Table 10.7 Application of the draft framework process to the CIS

Draft CEA framework process	Cumulative Impact Study process
Scoping: -identify potential cumulative effectsissues and VECs; -set appropriate geographical and temporal boundaries; - identify other actions	Scoping identified potential cumulative effects: additive, synergistic and neutralising. Geographic boundaries limited to area of 5 devts. Temporal boundaries: from construction to start of operation. Existing developments and receptors in the immediate area are identified.
Baseline conditions: -characterise environment and establish baseline and trends for valued resources	Baseline information based on information from ESs of five developments
Assessment of Effects: -identify impact pathways and cause and effect relationships -predict potential impacts -assess of significance	Identified causes of some impacts, such as construction activities (demolition and piling) resulting in noise impacts; Predicted potential effects of some impacts- noise, transport; Significance of impacts not fully assessed
Mitigation	Proposed mitigation measures for some impacts
Monitoring	none
Consultations	none

- **Scoping**

Scoping was undertaken to identify which environmental issues required further evaluation in terms of potential cumulative impacts. Types of cumulative effects were classified into: additive, synergistic and neutralising. Categories of potential cumulative effect issues addressed in the CIS are listed in Table 10.5. Issues that were considered additive were excluded from further evaluation since further assessment would not have provided additional understanding of the potential impacts. The reason given was that additive impacts are site specific and that there is a lack of potential for trans-boundary effects. Scoping therefore focused on synergistic or trans-boundary impacts (where the impact is greater than the sum of the individual impacts) and neutralising (where impacts counteract each other, reducing the overall impact).

The spatial boundary of the study was limited to the area covered by the five proposals. The temporal boundary included the following phases of the individual developments: demolition or modification of existing buildings and construction and operation of the proposed developments. Traffic impacts were considered until 2005. The CIS referred to the sensitive receptors that are likely to be affected and stated that these receptors are likely to change as the developments are constructed.

- **Baseline conditions**

The baseline conditions used in the study were based on:

1. information from individual EIAs on existing conditions in the development sites and the Millennium Quarter. The baseline descriptions included data on existing air quality, water resources, ecology, archaeological resources, traffic flows and background noise levels.

2. information from transport studies (Arup, 2001) to assess the effects of the developments in the context of the Allot and Lomax transport model (cited in Arup, 2001) for the Millennium Quarter Master Plan.

Included in the baseline is a description of the MQ Master Plan, components of the six proposed developments and some baseline data on valued resources (ecological). The CIS was basically a desk study and no new survey was undertaken.

- **Assessment of effects**

The assessment of effects was presented in three sections, each section dealing with a particular type of potential cumulative impact: additive, synergistic and neutralising. Although all the potential impacts were discussed, the focus was on the synergistic impacts, particularly the cumulative effects on traffic and transport, air quality and noise. For noise impacts, the development phase where these impacts might occur were indicated. However, the specific activities that might trigger such effects, such as drilling, piling, etc were not described and neither were the effects of such activities quantified. In terms of pathways, increases in traffic flows in certain roads in the MQ were considered. A conceptual analysis of potential interactions of noise construction impacts between proposed developments was conducted to identify likely areas to be affected. Another area where impact pathways were considered was in the qualitative risk assessment of potential ground contamination. A summary of the risk assessment is presented in Table 10.8.

Table 10.8 Summary of Risk Assessment of potential ground contamination (Environ, 2001)

Source	Pathway	Receptors	Risk
Historic trace metal and other contamination in soils	Vertical migration through silty alluvium and peat Piling operations Existing and new drainage pipes	Minor Aquifer	Low
As above	Vertical migration through	Major Aquifer	Low

	Lower London Tertiaries Excavation for construction Piling operations		
As above	Inhalation of dusts, ingestion	Construction workers End users of soft landscaped areas	Low
As above	Uptake by plants should their roots penetrate to the fill	Planting for soft landscape works	Medium

Some potential impacts (traffic and noise) were quantified while other impacts such as visual effects were assessed qualitatively. The assessment of significance was based on existing standards (such as Air Quality (England) Regulations 2000 for all pollutants and BS 5228:1997 for noise). Guidance used for prediction included the Design Manual for Roads and Bridges (DETR et al 1994) and the Calculation of Road Traffic Noise (DoT and Welsh Office, 1988).

- **Mitigation**

Mitigation measure proposed in the CIS included adopting an 'all-embracing CoCP' to control potential construction impacts such as noise, dust, soil contamination and traffic. It also suggested the preparation of Environmental Management Plans for each site. The CIS proposed that CoCP identify restrictions and targets for the works to minimise environmental effects and a procedure for notification with the Council and affected parties.

- **Monitoring and consultations**

No monitoring programmes were proposed and there were no consultations undertaken in the preparation of the CIS.

10.6.5 Case Study Conclusions

This Case Study illustrates a development control approach in addressing cumulative effects. Although a Framework Plan was prepared for the Millennium Quarter, cumulative effects were dealt with during the development control process. To address potential cumulative effects, the Council initiated a review of some EISs, a Cumulative Effects Study and a Code of Construction Practice to manage noise impacts. However, the review and the CIS were based mainly on information from six EISs. The description of other relevant actions was not comprehensive since it did not include other developments in the MQ and Isle of Dogs. Apart from transport and visual impacts, the geographical scope for the CIS was limited, since the analysis only

considered impacts on the immediate area. The temporal scope for the CIS was too short, only covering the period from the construction phase to 2005.

Apart from transport impacts that were assessed in a Transport Study, which was undertaken as part of the Master Plan of the MQ Area, cumulative effects were generally addressed during the determination of planning applications. The main outcomes of the Council's approach were:

- The Council's attempts to resolve cumulative effects issues at the development control stage resulted in delays in determining planning applications and a costly court case;
- The CIS and Review of the EISs were limited in scope so that it did not effectively assess the potential cumulative effects of developments in the MQ;
- These studies were undertaken too late in the planning process so that mitigation measures were limited to planning conditions;
- The Council tried to manage cumulative noise effects through a Code of Construction Practice, which could only be used as guidance, is reactive and its effectiveness not guaranteed.

Applying the CEA Framework would have resulted in improvements in the consideration of cumulative effects. Criteria for gauging improvement, which are outlined in Section 10.5, page 203, include: relevance to decision-making, effectiveness and efficiency. If the CEA Framework had been applied during the preparation of the MQ Framework Plan, the process for addressing them would have been set early in the planning process. Cumulative effects issues would have been identified at the start and clear objectives to guide the process established. These would have facilitated identification of development options for the MQ, a timely assessment of potential impacts and a process focused on significant cumulative effects issues, all relevant to the various stages of decision-making.

Furthermore, the process would have been more effective because it would have been systematic and strategic. Mitigation measures to address impacts for the whole area could have been identified during plan preparation. For example, in certain areas such as Canary Wharf Developments and Excel Exhibition Centre, noise limits for the area were set during the planning stage. The analysis would have been comprehensive, where potential cumulative effects from all relevant activities in the MQ and the Isle of

Dogs would have been considered. Significance criteria for assessing impacts would have been determined, which would be useful in the determination of planning applications. As proposed in the Framework, a monitoring programme would have provided useful information to further assessments and a management plan would have addressed construction noise. Therefore, assessing cumulative effects at the planning stage would have enhanced the planning process. Furthermore, the CEA would have contributed to a more efficient process by facilitating the approvals process and assisting the preparation of EISs in several ways. A baseline for the whole area would have been established, which could be used in preparing project EIAs. The CEA would have focused on the important effects that needed to be addressed which should guide individual EIAs in assessing its individual contribution. The proposed Framework could therefore help in reducing delay and minimising costs. A summary table of aspects where the CEA Framework would have improved the case studies is presented in Table 11.5.

10.6.6 Applying the network analysis method

Network diagrams indicating environmental impacts from construction and operation in the MQ were constructed. Environmental impacts were identified from documents relating to the proposed developments and from the literature on construction methods and impacts (e.g. transport, waste and ecology). The documentary sources are listed in Appendix 6. Another source of information were the interviewees, particularly the Planning Officers and the EHM.

Due to potential increase in population in the MQ, one cumulative impact related to transport. To address this, the Council had a Transport Model Study (Arup, 2001) prepared and agreements with the DLR to increase capacity. Data from the EISs and Transport Study were used in the analysis of impacts and potential transport impacts related to: increase in road traffic and public transport demand (DLR and buses). Road traffic impacts include: congestion, air pollution, noise and delay (DOT, 1993; Hughes, 1995). The degree to which receptors will be affected will vary depending upon the severity and time of exposure. Public transport impacts include congestion and delay. The Council adopted a policy of limited parking which should reduce car use, which could result in increased demand for public transport (i.e. more train services in the DLR). Network Diagram 10.1 indicates the potential impacts from construction and Diagram 10.2 shows potential impacts during the operations phase of the Plan. The

impacts on public transport are likely to be more significant during the operations period.

It was quite clear that the Council's main concern was construction noise. Noise at construction sites varies relative to the particular operation but there are activities that contribute to these impacts: ground clearing and demolition; excavation; piling, erection of walls, floors etc.; operation of machinery and movement of materials to and from the site. The impacts of noise include: damage to hearing or health, annoyance and interference with work tasks, speech communication, and sleep (Mestre and Wooten, 1980; Jain et al, 1981; Therivel, 1995; Canter, 1996).

Continued exposure to noise may lead to land use changes, precipitating a series of socio-economic (lower value of properties, unable to socialise outside the house) and biophysical impacts such as stress. PPG 24 (Planning and Noise) states that housing, hospitals and schools are regarded as noise sensitive developments. The potential noise impacts from construction are set out in Diagram 10.3. The sources and activities, which lead to noise impacts were identified as well as higher order impacts. The noisiest activities are those relating to demolition and piling. In Diagram 10.4, the sources, pathways and receptors and interactions, which lead to cumulative noise impacts are set out. This diagram incorporates some quantitative data, which can indicate potential significance. The diagram assumes that impacts would be more adverse if the proposed developments were implemented concurrently, which is the worse case scenario. It is likely that there will be some overlapping of effects because planning permissions were submitted at about the same time and the main reason for the Council's request that a CIS be prepared.

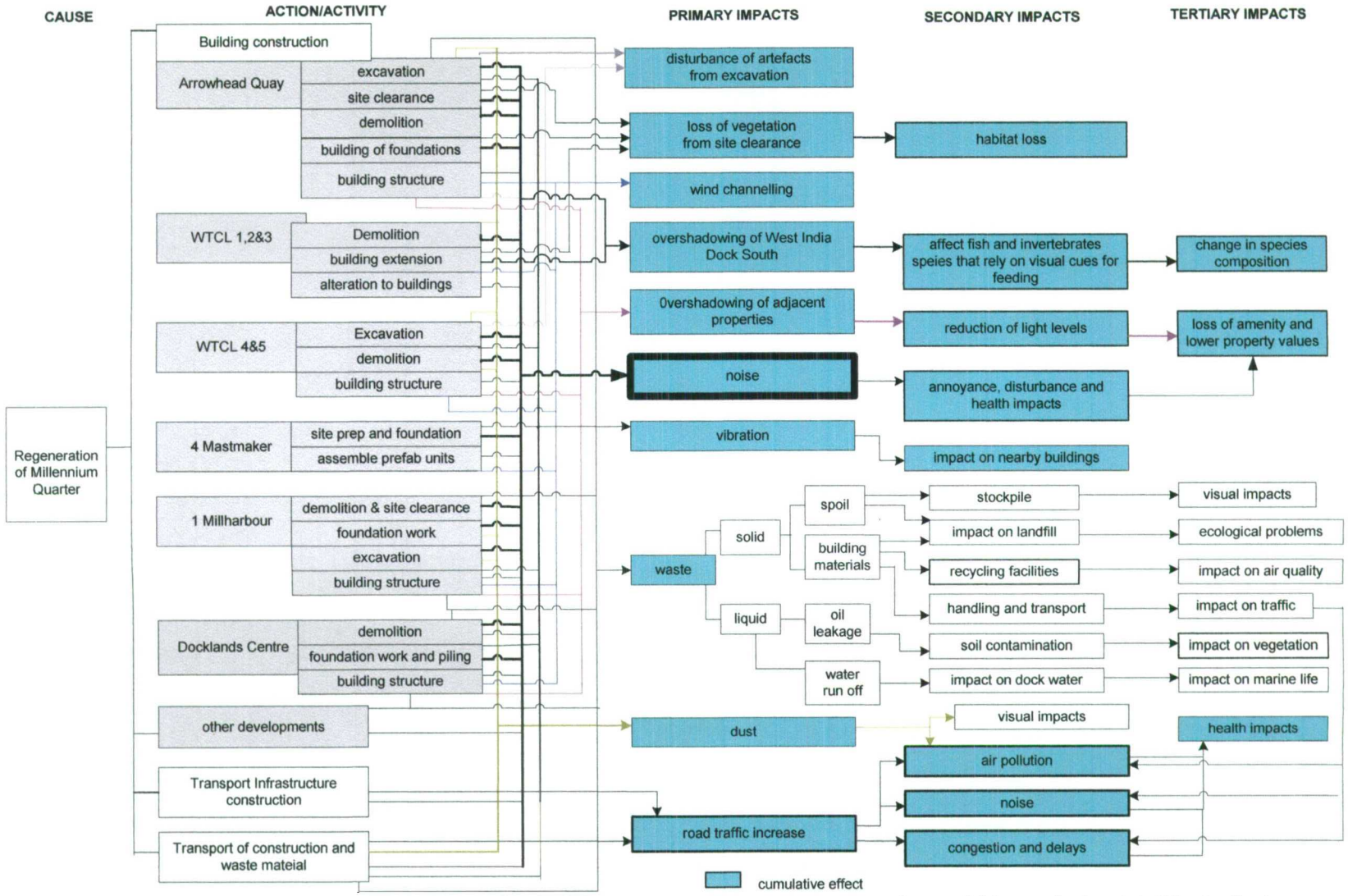


Diagram 10.1 Construction Impacts in Millennium Quarter

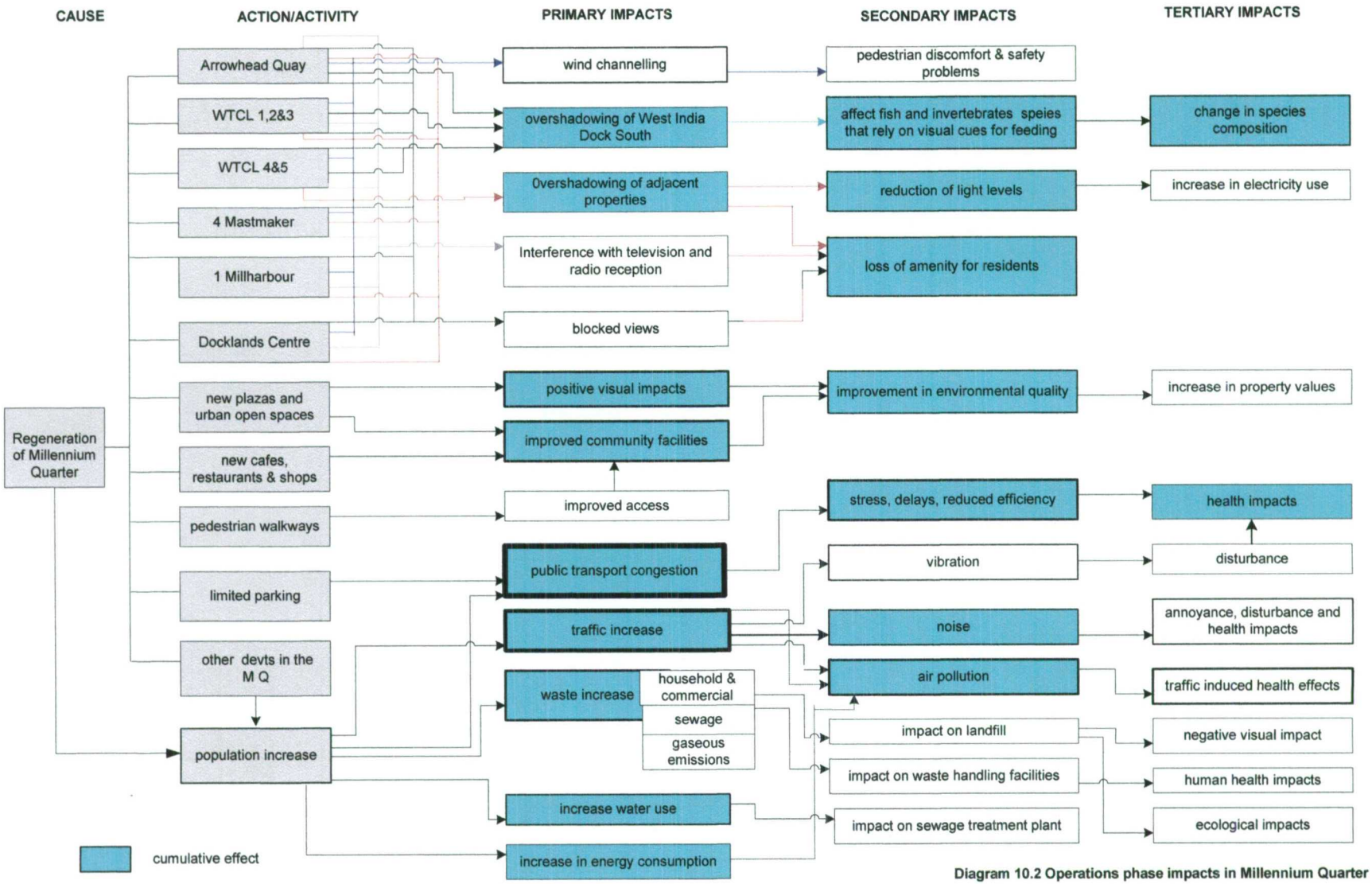


Diagram 10.2 Operations phase impacts in Millennium Quarter

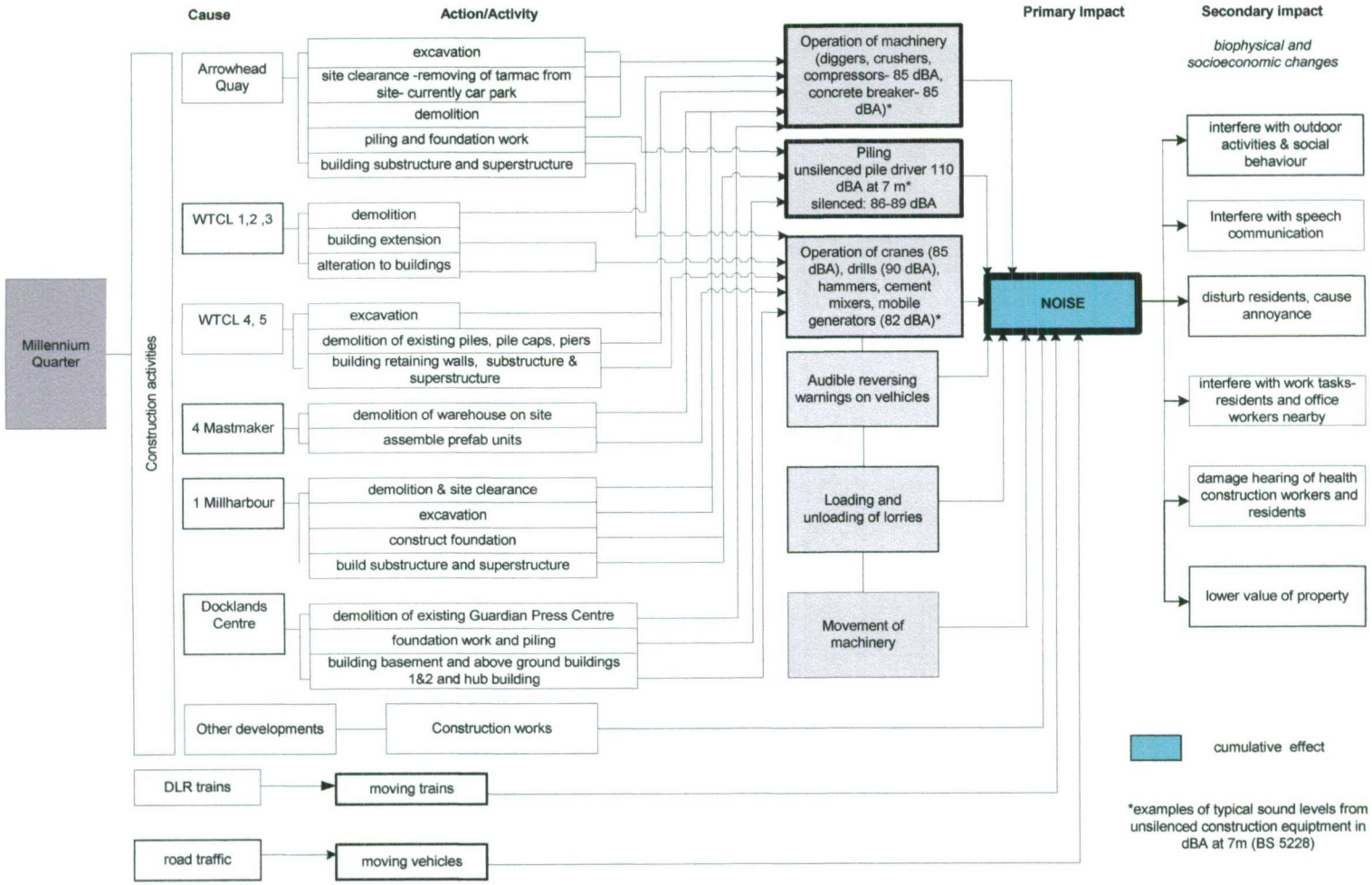
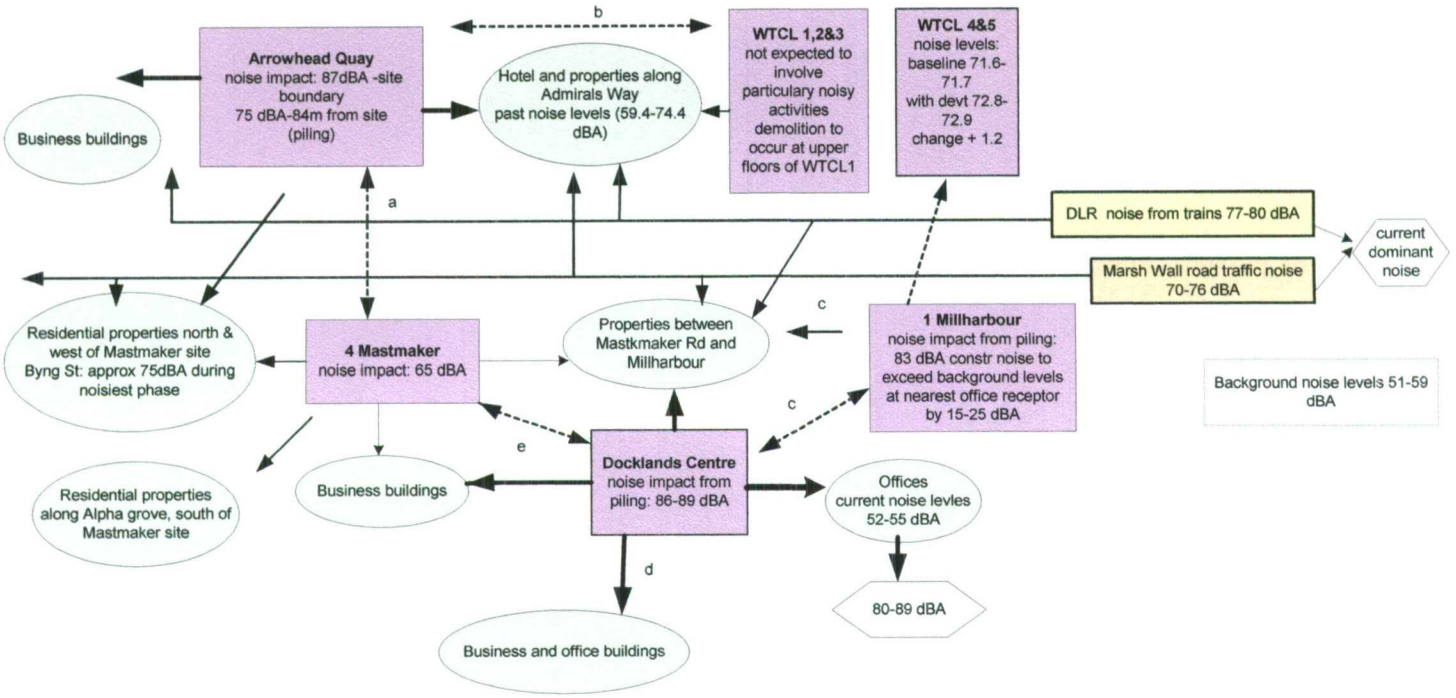


Diagram 10.3 Potential noise impacts from Millennium Quarter developments



most sensitive receptors

- construction noise criteria (BS 5228) - 70- 75 dBA(day)
- WHO criteria - outdoor noise less than 55 dBA desirable to prevent significant community annoyance

a - interaction between Arrowhead Quay and Mastmaker worst case construction noise from Arrowhead Quay piling activities while Mastmaker less noisy due to major components prefabricated off site

b - interaction between Arrowhead Quay (AQ)and WTCL 1, 2,3 - a numberof properties along Admirals Way mostly from AQ piling activities

c - interaction between WTCL 4&5, Millharbour and Docklands Centre could result in area north of Millharbour+ DLR and road traffic noise likely to be over 75 dBA

d - business and office buildings surrounding Docklands centre measured noise levels (Danilo Printing (52-55 dBA L90), Visual House (53-33 dBA L_{90} and Great Eastern Enterprise (51-55 dBA L_{90}) predicted levels due to piling activities will exceed the background noise levels by about 30 dBA

e - interaction between4 Mastmaker Rd and Docklands Centre (DC) site level of noise highest during DC piling ranging from 86 to 89 dBA

f - increase of 25% in traffic volume due to developments - predicted noise level increase- 1 dBA

Diagram 10.4 Cumulative noise impacts from Millennium Quarter developments



View from Millharbour of WTCL 1, 2, 3 (left) and WTCL 4, 5 (right)



Arrowhead Quay Site



1 Millharbour Site



London Millharbour (Docklands Centre)



Weston Homes



Marsh Wall Road



Residential Area – Byng Street



Canary Central Apartments

10.7 Case study 2: Creekside area

Background

The original *Creekside Strategy* was formally adopted by the Boroughs of Lewisham and Greenwich in November 1993 to provide a comprehensive and co-ordinated approach to the Creekside area. It sets out the long-term plan for the area and introduces new uses and activities alongside existing ones. The area is shown in Map 10.3, covering parts of Lewisham and Greenwich. In the early 1990s, Deptford and West Greenwich, the location of Creekside, had 24% unemployment, the highest rate in both Lewisham and Greenwich and declining local industry. Greenwich and Lewisham therefore set out to try to increase investment in the area and regenerate the environment. Two development frameworks have been prepared to guide development: the West Greenwich Development Framework (WGDF), which was adopted as Supplementary Planning Guidance in 2000 and the Creekside Area Development Framework (CADF) (Lewisham, 2001). In addition, a Creekside Urban Design Framework has been produced (EDAW, 2001).

There has been considerable pressure for development in the area. The Creekside is currently occupied by a wide variety of land uses, mainly industrial, including aggregates, motor vehicle related uses and manufacturing. Several sites are run down, under-used and the environmental conditions generally poor. The area is quite accessible via the DLR and the Jubilee Line Extension. There have been some major developments:

- Millennium Quay (Greenwich): primarily residential redevelopment of land on the western boundary of the Creek, north of Creek Road;
- Rachel Macmillan (Greenwich): refurbishment of the teaching block by Goldsmiths University for faculty and new student accommodation on the Stowage site;
- Rose Bruford College (Greenwich): offices, flats and retail units;
- The Laban Dance Centre (Lewisham): arts centre dance school;
- Seagar Buildings, Deptford Broadway (Lewisham): mixed use of offices, housing and light industrial space.

Major proposals in the area are listed in Table 10.9. There are also proposals outside Creekside (Cutty Sark Station site for mixed use development), which, in combination

with the proposed developments in Creek Road, may have a cumulative impact on traffic along Creek Road.

Table 10.9 Major proposals in Creekside

Proposed development	Uses	Status
Greenwich Reach 2000 (Greenwich) on the eastern boundary of the Creek, north of Creek Road	mixed use redevelopment of land (cruise liner terminal, flats, shops and restaurants)	planning permission granted (2002)
Greenwich Meridian (Greenwich and Lewisham)	offices, flats and open space	planning application granted by Greenwich (2003) but refused by Lewisham – negotiations on-going
Hilton's Wharf, Norman's Road (Greenwich)	mixed use development of office buildings, light industrial units and work/live residential block and underground car park	outline planning application submitted (1998)
Haddo Estate (Greenwich)	demolish existing buildings and provide 184 residential units	planning permission granted in July 2000
Convoy's Wharf (Lewisham)	mixed use scheme (commercial and housing) in 16 hectare site	planning application submitted (2002)
Brewery Wharf (Greenwich)	concrete mixing and batching plant with new silo	planning application submitted
Mumford's Flour Mill (Greenwich)	Development of new flats, upgrading of commercial space and renovation of main buildings	planning permission granted March 1999
Wood Wharf (Greenwich) Thames Street	Seven storey building of residential, restaurant and community uses with basement parking – 48 residential units	planning application granted

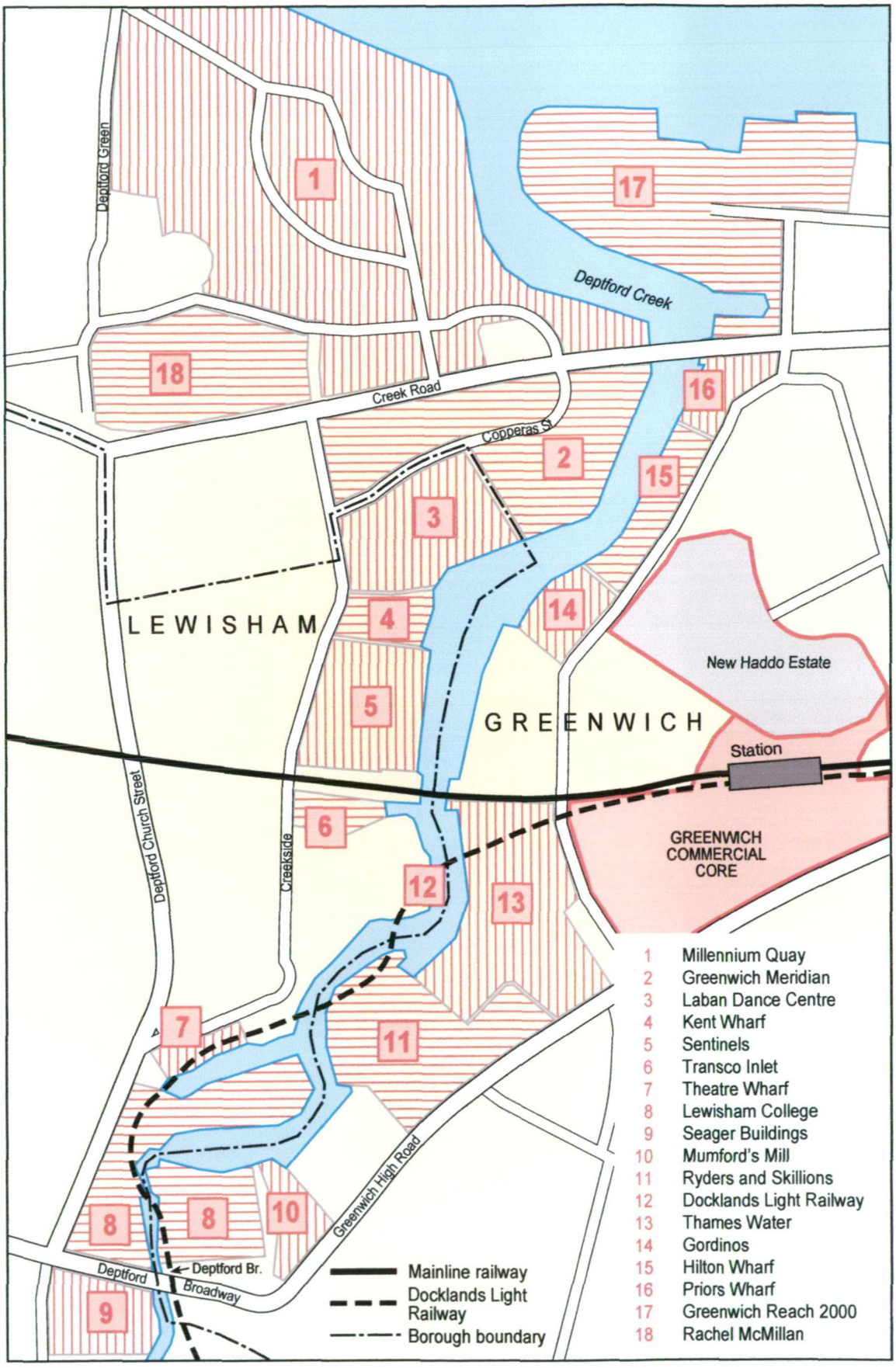
The key objectives to the strategy for regeneration of Creekside were to: create and retain employment opportunities; identify and seek greater variety in economic and social activities and opportunities in the Creekside area; identify potential use of the Creek water area; identify and improve access to the Creek and linkages with Greenwich town centre and Deptford High Street and identify and secure environmental upgrading opportunities in the area.

The Issues

The preservation and enhancement of the Creek is an important consideration in any regeneration scheme relating to the Creek area (Greenwich Council, 2000). Apart from the developments, the much-needed repair and rebuilding of the Creek walls would also impact on the wildlife. A major issue was to protect the already established habitats and species found in the Creekside, which included wasteland habitats and locally distinctive and rare species such as Kingfishers and Black Redstarts. One of the government's sustainability indicators is the proportion of brownfield land built on

instead of greenfield land. All wildlife habitats in Deptford are on brownfield sites. These sites have a variety of biologically rich brownfield habitats: some are large such as the Deptford Power Station and others are small, such as the back of the Sentinels building (See Map 10.3). All these fragments contribute to the overall viability of wildlife population in the area (Creekside Education Trust, 2002). The threat to the wildlife of the area was seen as not within the Creek but on the surrounding land (Ibid, 2002).

Another environmental issue is increase in road traffic and demand on public transport. Creek Road is the main road connecting East and West Greenwich and can be congested during peak times. Major developments in the area are likely to increase congestion.



Map 10.3 Creekside Area Developments *Source: Creekside Education Trust (2002)*

10.7.1 The Councils' Approach

The regeneration of Creekside involved a partnership approach between two London boroughs: Greenwich and Lewisham. As shown in Figure 10.2, the development frameworks provided the vision and guiding principles for the area. The assessment of impacts, however, was carried out during the development control and EIA processes. The approach adopted in this case study was therefore a development control model with stakeholder participation.

A number of statutory and non-statutory organisations and individuals have worked together to bring about benefits to the environment and the community. These include the Environment Agency, the Port of London Authority, Docklands Light Railway, English Heritage and riverside owners. The Environment Agency is concerned with the environmental impact of works (river walls) or development adjacent to them and has a strong policy against encroachment and a commitment to protect and create habitat for protected and local wildlife (Bertrand, 2002). The Agency has undertaken the repair and replacement of several river walls on the Creek as part of the regeneration of the area. Several development schemes have used innovative techniques when realigning flood defences, such as re-creation of sloping gravel beaches, encouraging saltmarsh establishment and creation of an artificial kingfisher bank. Local organisations, such as the Ecology Group have been involved in suggesting mitigation measures to ensure that regeneration does not lead to adverse impacts.

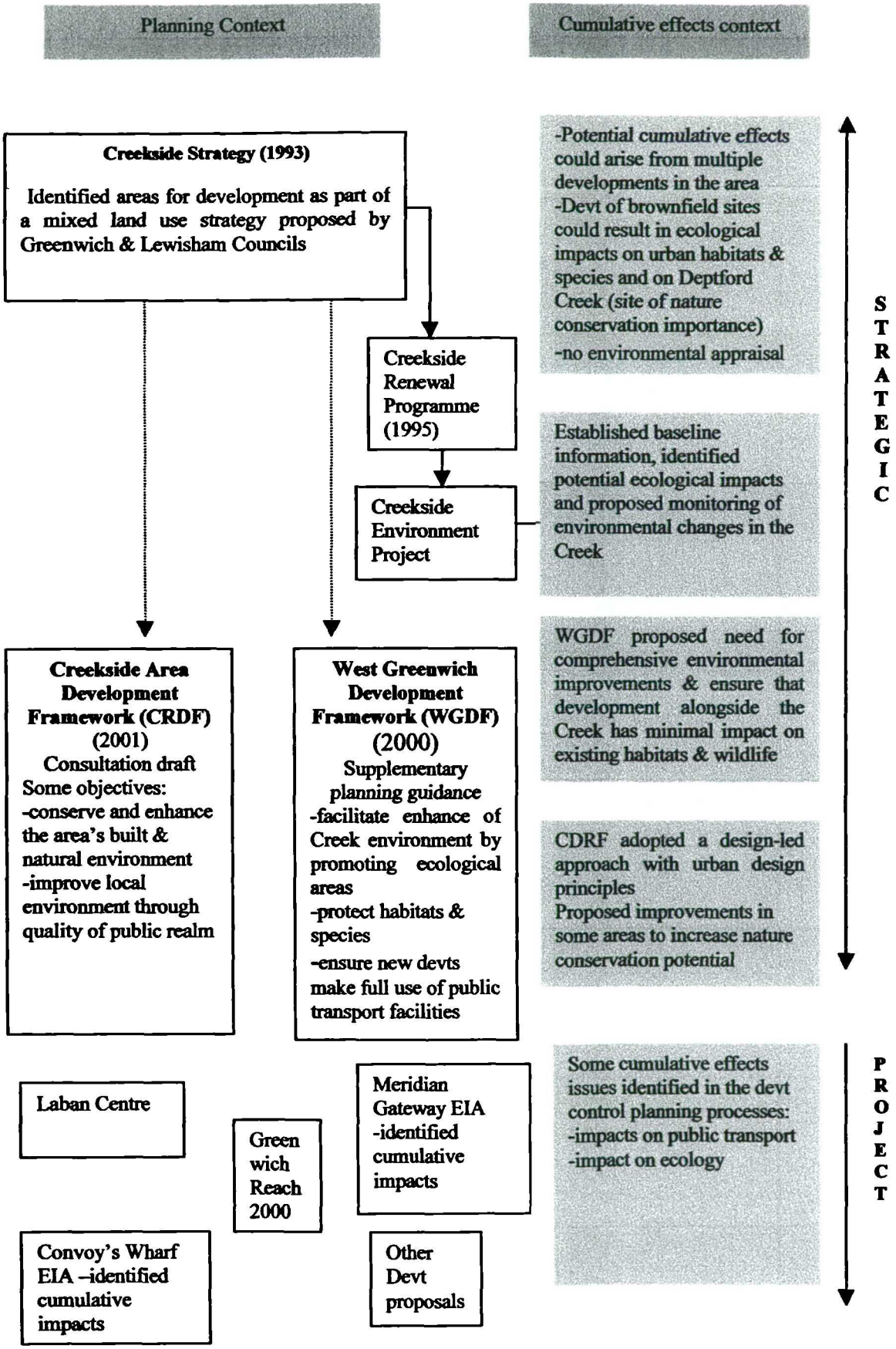
To oversee the implementation of the Creekside Renewal Programme (Single Regeneration Budget (SRB) funded), a Creekside Renewal Partnership was established. This Partnership brought together the public, private and community sectors to realise the vision for the area and sought to improve the environment of the Deptford Creek River walls and channel, create new public spaces and strengthen linkages between Greenwich and Deptford.

A major component of the SRB bid was the improvement of the local environment, which resulted in the Creekside Environment Project. This Project has been instrumental in identifying potential ecological impacts and suggesting mitigation measures to developers during the consultation processes. The objectives of the project were to:

- establish baseline information and monitor change;

- develop engineering solutions for the treatment of vertical river walls to recreate the hanging gardens provided by the decaying walls and timbers at present;
- devise a strategy informed by the baseline data to manage the development of the Creek and protect it against misuse in the future
- clean the Creek.

Figure 10.2 Planning Context: Deptford Creekside Area



10.7.2 Evaluating the Approach in Creekside

In this section, the approach used in the case study for considering cumulative effects is evaluated against the approach proposed in the CEA framework. The findings are set out in Table 10.10.

Table 10.10 Application of the draft framework approach in Creekside

Criteria	Creekside Approach
Clear objectives and guiding principles	The Development Frameworks and Urban Design Framework stated environmental protection objectives and guidelines.
Integration into the plan-making process	Cumulative effects are taken into account in the development control process.
Commitment	Cumulative effects considered by planning officers Environmental stakeholders proposed mitigation of cumulative effects; undertook baseline surveys
Multiple organisation involvement	Objectives and guidelines for frameworks identified through stakeholder consultations. Local organisations and government agencies have worked with developers to identify ecological mitigation measures.
Better understanding of cumulative effects	Surveys provided improved understanding of condition of resources and cumulative effects from past developments.
Input to strategic planning	Cumulative effects issues have been considered by planners in the context of the whole area during the development control process.
Contribution to decision-making	Cumulative effects considered in development control process

Environmental objectives included protecting and enhancing the ecological resources. Guiding principles included ensuring that new developments don't encroach on the Creek or disturb the existing ecology and to enhance the ecology of the Creek walls. Other guiding principles relate to transport impacts and states that "*the two Borough Councils should ensure, in assessing development proposals, that the* ***cumulative impact of schemes are considered***" (EDAW, 2001, p.48).

According to the Planning Officer (development control) for Greenwich, one of the main factors he considered in the determining whether to grant planning permission to one development, the Meridian Gateway, was the cumulative impact of the development on public transport. The Officer's decision was based on the Public Transport Accessibility Level (PTAL)[4] for the area given by Transport for London (TfL cited in GLA, 2003) . The PTAL model measures relative levels of accessibility to public transport provision, taking into account walk access time and service availability. But planning permission for Meridian Gateway was refused by Lewisham Council

[4] The PTAL rating of 3-4 was given for the site. The highest level of accessibility is given a rating of 6.

(where approximately one quarter of the application site falls). The Planning Officer (development control) for Lewisham was concerned about the precedent that a development of this scale might set, including its "*cumulative impact on the public transport infrastructure*" (LBL, 2003, p.62). The Planning Officer was doubful about the capability of public transport to cope with a further increase in demand especially if the scale of development proposed is repeated on both sides of the Creek. This was based on professional judgement[5]. This Officer was concerned about the precedent that the development might set, which could lead to increase in potential cumulative impacts on transport.

Although the Councils have a shared vision for the area and common policies such as limiting parking spaces on roads and promoting transport, this example shows the different approaches that planners can take with regards to assessing cumulative impacts and the problems when there are no agreed criteria for determining significance.

Many organisations have been involved in the regeneration of Creekside. The most active has been the Creekside Project which has commissioned baseline surveys at the planning stage and have been actively promoting and discussing the creation of new habitats (brown roofs and river wall terracing) to mitigate the cumulative impacts of habitat loss from developments along the Creek. In addition, areas of river terracing have been agreed with the Environment Agency to improve flood storage and provide ecological habitat (as in the Greenwich Reach site).

Other stakeholders have also shown an understanding of the role of cumulative effects. The Creekside Forum, in commenting on the Meridian Gateway EIS, observed that *cumulative effects* are assessed by considering the scheme in conjunction with other permitted developments so that the combined effects are considered. They go on to suggest that "*this is an important function of the assessment, since it enables the local planning authority to understand the impacts of the proposed development in the context of the existing situation, and the situation which will exist, when other permitted developments are built*" (Creekside Forum, cited in LBG, 2003, p. 41).

As can be seen in the previous sections, although cumulative effects have been recognised at strategic level, their assessment was conducted during the project

[5] Personal communication from planning officer, July 2003.

development control process. EIAs have been required to consider cumulative effects and the overall cumulative impacts were then considered by the Planning Officers in reaching a decision. Although environmental objectives were stated in the development frameworks and cumulative impacts referred to in the Creekside Urban Design Framework (EDAW, 2001), they were not subject to appraisal which would have highlighted potential cumulative effects problems. The GLA suggested that given the pace of change being experienced in the Thames Gateway, a comprehensive master plan of the area should be completed building on the work already done by Greenwich and Lewisham Councils (GLA, 2003). Ideally, the plan should be undertaken prior to a decision being made on this application (Meridian Gateway), thereby enabling the proposal to be viewed strategically (Ibid, 2003). It should be noted that a master plan of the area, the Creekside Urban Design Framework has been prepared but the focus was on design, which is typical of master plans. According to the Planning Officer (development control) from Greenwich, the approach he uses for assessing cumulative effects is analysing capacity and including impacts from smaller developments such as Rose Bruford and Rachael Macmillan which did not have EISs. The Officer also noted that a cumulative impact study would have been useful to decision-making. Referring to Figure 10.2, CEA could have been integrated at the level of the Creekside Strategy of the Framework Plans. The review of appraisals as part of this research (see Chapter 6) revealed that the SAs of Greenwich and Lewisham UDPs did not address cumulative effects. When the UDPs are revised, CEA should be integrated in future SEAs.

Some interviewees noted the many factors to consider as a constraint to CEA. The Nature Conservation Officer (Lewisham and Project Manager, Creekside Project) commented that the large schemes take a long time to construct and so the effects are difficult to predict but if the potential impacts are identified early enough, mitigation measures can be incorporated into the design. The Officer observed some factors for effective CEA implementation: organisational framework, knowledge of cumulative effects and expertise in assessing cumulative impacts.

The Planning Officer (Greenwich – development control) suggested that policies at strategic planning level could mitigate cumulative effects and, at UDP level, targets can be set to address cumulative effects (e.g. residential units based on transport capacity). He also suggested that action plans and the proposed local development frameworks may be the level at which cumulative effects could be addressed.

10.7.3 Evaluation of the process for addressing cumulative effects

The process adopted by the planning authorities was evaluated against the CEA process in the draft framework. It should be noted that since the Councils' approach is based on the EIA processes, the analysis is based on the EIA documents and supporting information such as committee reports. The results are shown in Table 10.11.

Table 10.11 Application of the draft framework process to Creekside

Draft CEA framework process	Creekside process
Scoping: -identify potential cumulative effects issues and VECs; -set appropriate geographical and temporal boundaries; - identify other actions	Scoping has been conducted for individual EISs but does not mention cumulative effects Geographic boundaries of EISs limited to area of devts. Temporal boundaries for EISs: from construction to start of operation. Existing developments and receptors in the immediate area are identified in EISs.
Baseline conditions: -characterise environment and establish baseline	Baseline information limited to specific sites
Assessment of Effects: -identify impact pathways and cause and effect relationships -predict potential impacts -assess of significance	Identified causes of some impacts, such as ecological and transport impacts; Predicted potential effects of impacts; Some EISs considered cumulative effects; Significance of impacts not fully assessed
Mitigation	Proposed mitigation measures for some impacts
Monitoring	none
Consultations	With some stakeholders

- **Scoping**

Some developments in the Creekside were not required to prepare EIAs (e.g. Fairview Homes, Rose Bruford) but instead, environmental reports were prepared (e.g. Laban Centre, Greenwich Reach). In the Meridian Gateway EIA (Arup, 2001), scoping was undertaken during the early stages of the baseline gathering exercise. Consultation meetings were undertaken with the local planning authorities concerned, Greater London Authority, Transport for London, the Environment Agency and other appropriate bodies. A workshop was also held with members of the Creekside Ecology Forum. An initial appraisal of environmental effects was made, based on expert judgement and review of relevant documents. However, the EIA does not mention what effects these are.

The Convoys Wharf EIA undertook scoping and some potential impacts identified included noise, air pollution, waste, ecology and transport. Consultations were held with local authorities and other organisations to identify key issues.

- **Baseline conditions**

Ecological survey data collected in 1997 and 1998 by the Creekside Project provided detailed information about the Creekside area which was used by subsequent EIAs. The Meridian Gateway EIA carried out baseline surveys for the various sectors such as transport, noise, landscape and ecology. The baseline conditions for the network highlighted current traffic speeds, flows, bus patronage,cycle network usage and on-street car parking. Surveys were carried out at nearby residential developments to determine the likely trips that the site would generate. Neighbouring developments under construction likely to impact on local traffic flows were included in the assessment to determine the likely cumulative impacts. In other cases, such as air quality, available local monitoring data was used. The baseline conditions were focused on the site but other developments in the immediate area were taken in account. The Norman Wharves EIA baseline conditions focused on the site except for transport, where it considered the immdiate area. The Laban Centre environment report was also site focused. The Convoys Wharf EIA conducted surveys, such as habitat mapping.

- **Assessment of effects**

The Meridian Gateway EIA assessed direct effects, interaction of effects and cumulative effects. Neighbouring developments (where planning permission has been granted) in the vicinity of the site have been identified. The cumulative effects from these developments and the Meridian Gateway have been included in the overall assessment of the effects of the proposal. The Creekside Forum observed that the cumulative effects were assessed by considering the effects of the scheme in conjuction with other permitted developments, so that the combined effects were considered (Creekside Forum, cited in LBG, 2003).

Sources of impacts, such as construction activities were identified and the assessment of the impacts has been undertaken with reference to the nearest existing residential and commercial properties. The EIA also identified potential interactions of impacts during construction and operation. Modelling was used to assess impacts such as air quality and transport. Regulatory standards (e.g. air quality, water quality) were used to determine significance.

The Hilton Wharf/ Norman Road Wharves Development EIA identified potential impacts such as traffic, noise from construction operations and pollution of the Creek

from mobilisation of contaminated sediments arising from the reconstruction of river walls and dredging. The Laban Centre undertook some assessments of impacts, such as noise and a Transport Impact Study. The Convoys Wharf EIA considered impacts on air quality, ecology, trnasport, noise and ground contamination. In terms of ecology and nature conservation, potential direct and indirect impacts were identified.

- **Mitigation**

Mitigation measures were proposed in the EIAs but they were site related, such as adopting management controls during construction. The Creekside Project (now the Creekside Education Trust) promoted 'brownfield' or brown roofs and river wall terracing to provide habitats. These measures were proposed to the developers by the Creekside Project in order to mitigate the loss of habitats from construction activities. When plans for the Greenwich Reach development were first discussed it provided an opportunity to consider brownfield roofs. The developers took these suggestions on board and incorporated brownfield roof areas and river wall terracing in their planning application drawings. Because the Creekside Project was involved during the early stages of design, these elements were relatively easy to accommodate (Bertrand, 2002). Brown roofs were also incorporated into the designs of other proposed developments (Meridian Gateway, Convoy's Wharf and Seagar Buildings (under construction) and Kent Wharf). The Laban Centre, which has been constructed, incorporated brown roofs and timber clad river walls. The Creekside Education Centre built on the Transco Inlet site, incorporates a brown roof and the dock has been converted into a beach for natural colonisation for flood defence.

- **Monitoring**

The EIAs didn't propose any monitoring measures. However, the Creekside Education Centre (CEC) propose to monitor and manage roof areas according to an agreement developed between the Environment Agency, the CEC and the site owners. This agreement was incorporated into planning consents. Recently, monitoring activities have included sediment survey and an invertebrate survey on brown roofs and the CEC site.

- **Consultations**

The scoping stage of the EIAs included consultations. The Meridian Gateway EIA submitted an early draft of the EIS to the Creekside Ecology Forum for their comments, which were taken into account in the preparation of the final EIS.

10.7.4 Case Study Conclusions

This Case Study has highlighted the difficulties of assessing cumulative effects at the development control stage. The two local authorities had prepared the Creekside Strategy for the area, individual develoment frameworks and the Creekside Urban Design Framework to guide development. These documents referred to the need to address environmental impacts while the latter specifically mentioned that in assessing development proposals, the two Borough Councils should ensure that the cumulative impacts of schemes are considered. The analysis of potential effects was therefore undertaken during the development control process, through EIAs. The main outcomes of such an approach were:

- Assessing cumulative effects at the project level was piecemeal, where only some EISs addressed these effects. Although some EIAs considered cumulative effects, most of these assessments were limited to their immediate area. As a result, the overall effects of all the proposed and existing developments, including minor developments were not addressed.
- Project proponents had to prepare several versions of EISs, which caused delay and were costly. For example, a planning application and EIS for the Meridian Gateway were submitted in 2001. Since then, two amended EISs (2002, 2003) have been submitted to address transport, ecology, visual and cumulative impacts in order to obtain planning permission;
- The lack of common, agreed criteria for determining significance of cumulative effects on public transport resulted in different judgements by planners from the two local authorities on the same EIS. This has created confusion and disagreement;
- Mitigation measures were limited to planning conditions;
- Effects monitoring activities covered only some areas;
- Stakeholders took a proactive role in the process by establishing a baseline, identifying potential impacts and proposing mitigation measures but these were mostly reactive measures.

As the Planning Officer from Greenwich has suggested, a strategic CEA study would be able to identify capacities in the area from which targets could be set. By considering cumulative issues earlier in the planning process, it could assist project level assessments. Similarly, the application of the proposed CEA framework would have enhanced planning in this case study. The criteria for judging improvement are outlined in Section 10.5, page 203, which include: relevance to decision-making, effectiveness and efficiency. Applying the Framework in this case would have resulted in facilitating decision making by providing information on potential effects in a way that is timely and focused on important issues. The CEA would have provided information on the potential impacts of development options for the area so that informed choices could have been made.

The planning process could have been more effective by having clear objectives to address cumulative effects during the preparation of the Strategy, and the individual development frameworks. Thus, significant cumulative effects issues would have been considered early in the planning process. The Framework would have provided a systematic process for both planning authorities for considering impacts and help define cumulative effets issues for both. The baseline and trends of valued resources would have helped define the condition of the impact receptors and identify which impacts are likely to be critical. Furthermore, the scope of the CEA would have considered all proposed developments in the area, including minor ones. In terms of mitigation, the CEA would have considered a wide range of measures at strategic level, such as policies, which the authorities could adopt. Particularly relevant to this case, the CEA would have established appropriate methods and criteria for determining impact significance which could have been used by the two Borough Councils in determining planning applications. This would have avoided disagreements between the Councils later on, as well as delays and further costs to project proponents. A summary table of the aspects where the CEA framework would have improved the case study planning process is included in Table 11.5.

10.7.5 Application of the network analysis method

In constructing the diagrams, documents were reviewed to identify environmental impacts. Information sources are listed in Appendix 6. For example, in order to identify ecological impacts, studies and reports of the Creekside Project and the Creekside Educational Trust provided baseline data. To supplement those, interviews

with key stakeholders were conducted and the main sources of information were the Nature Conservation Officer and the Creekside Education Trust Officer. Several site visits were also undertaken.

Other issues investigated were transport and waste. Diagram 10.5 shows potential cumulative impacts from regeneration developments in Creekside during the construction phase. This diagram indicates impacts on ecology, transport and waste. Transport impacts during construction are shown in Diagram 10.6 while transport impacts during the operational phase are indicated in Diagram 10.7. Ecological impacts during construction are shown in more detail in Diagram 10.8. Potential ecological impacts during the operational phase are set out in Diagram 10.9.

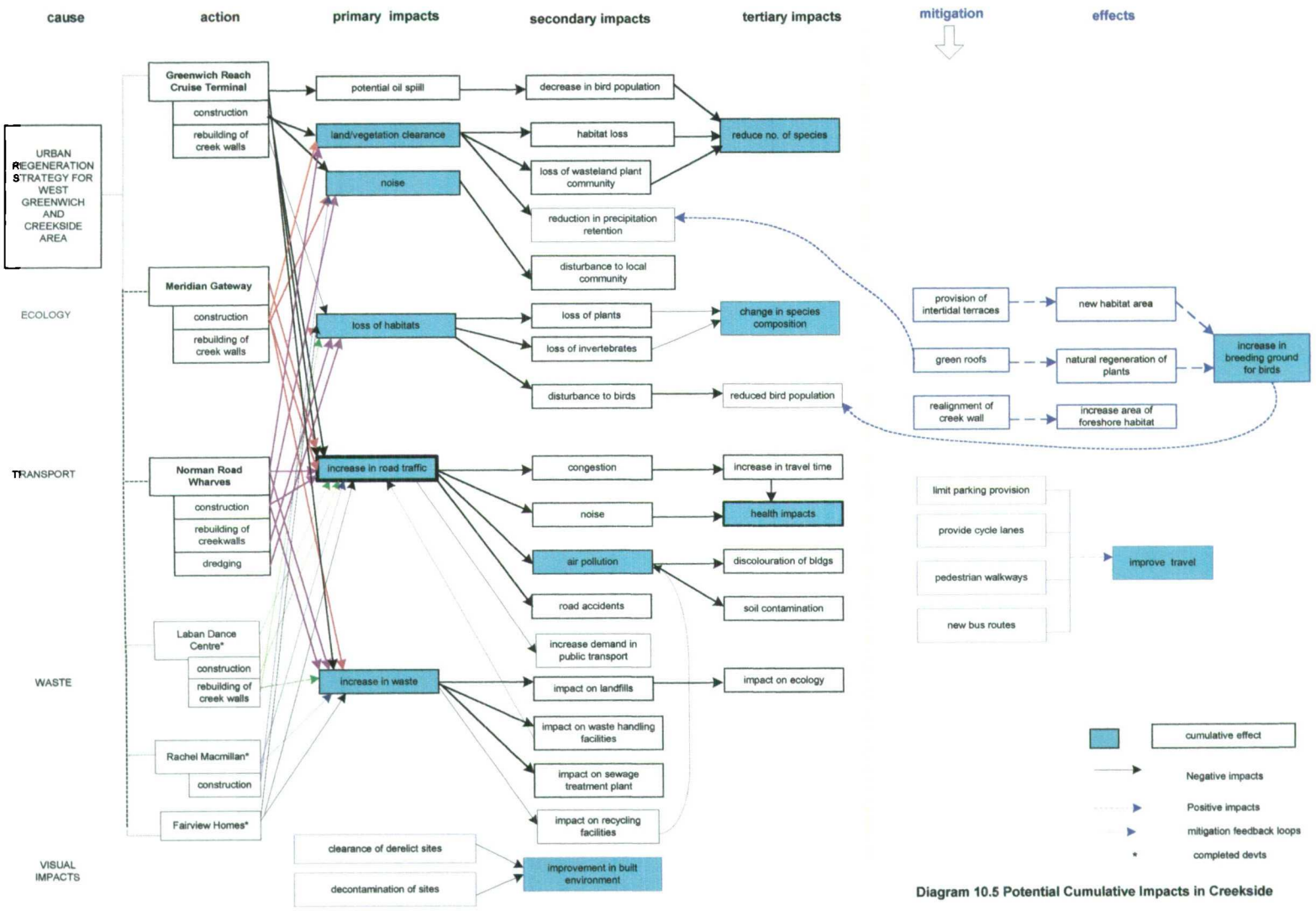


Diagram 10.5 Potential Cumulative Impacts in Creekside

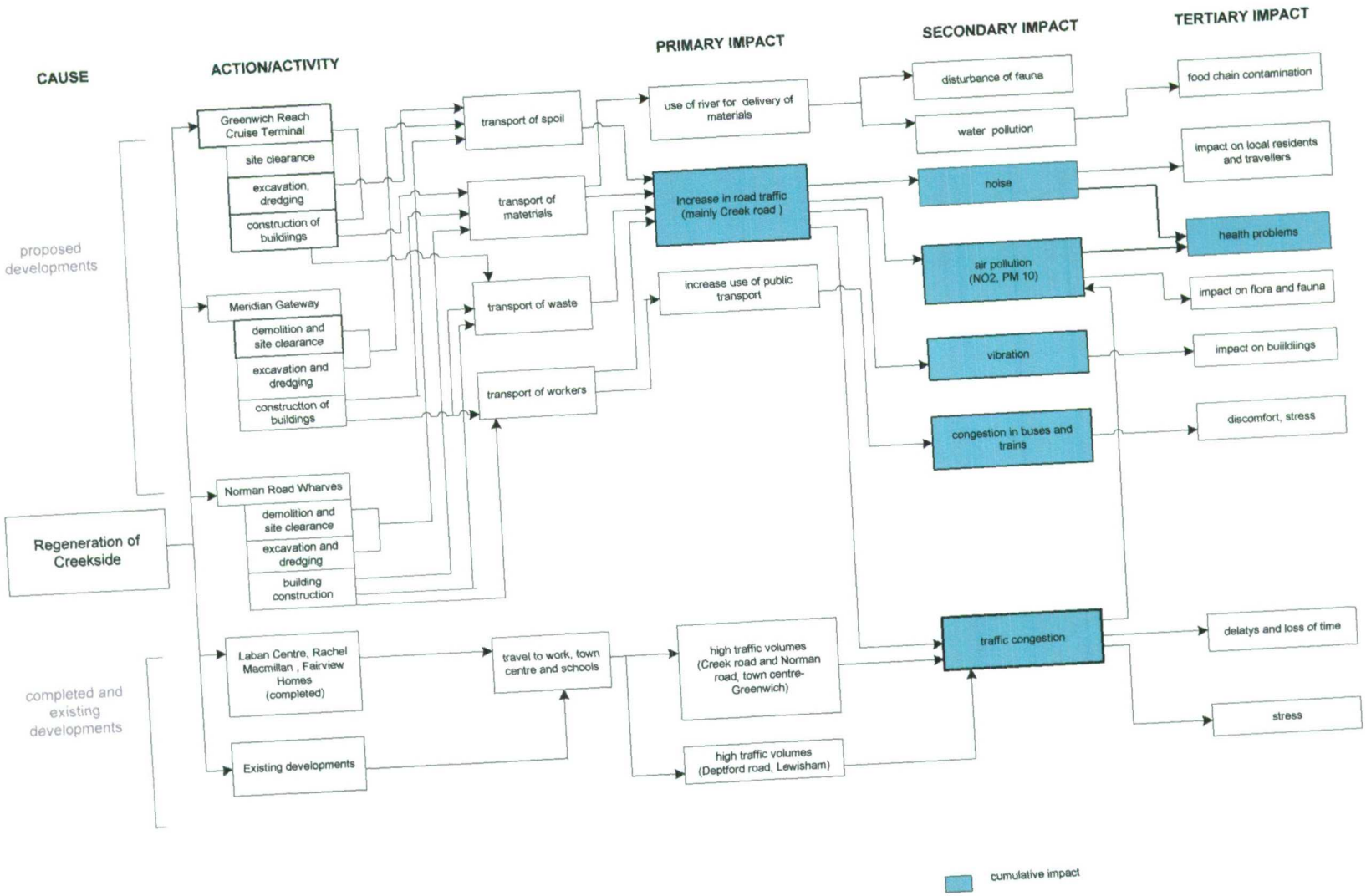


Diagram 10. 6 Transport impacts in Creekside (Construction phase)

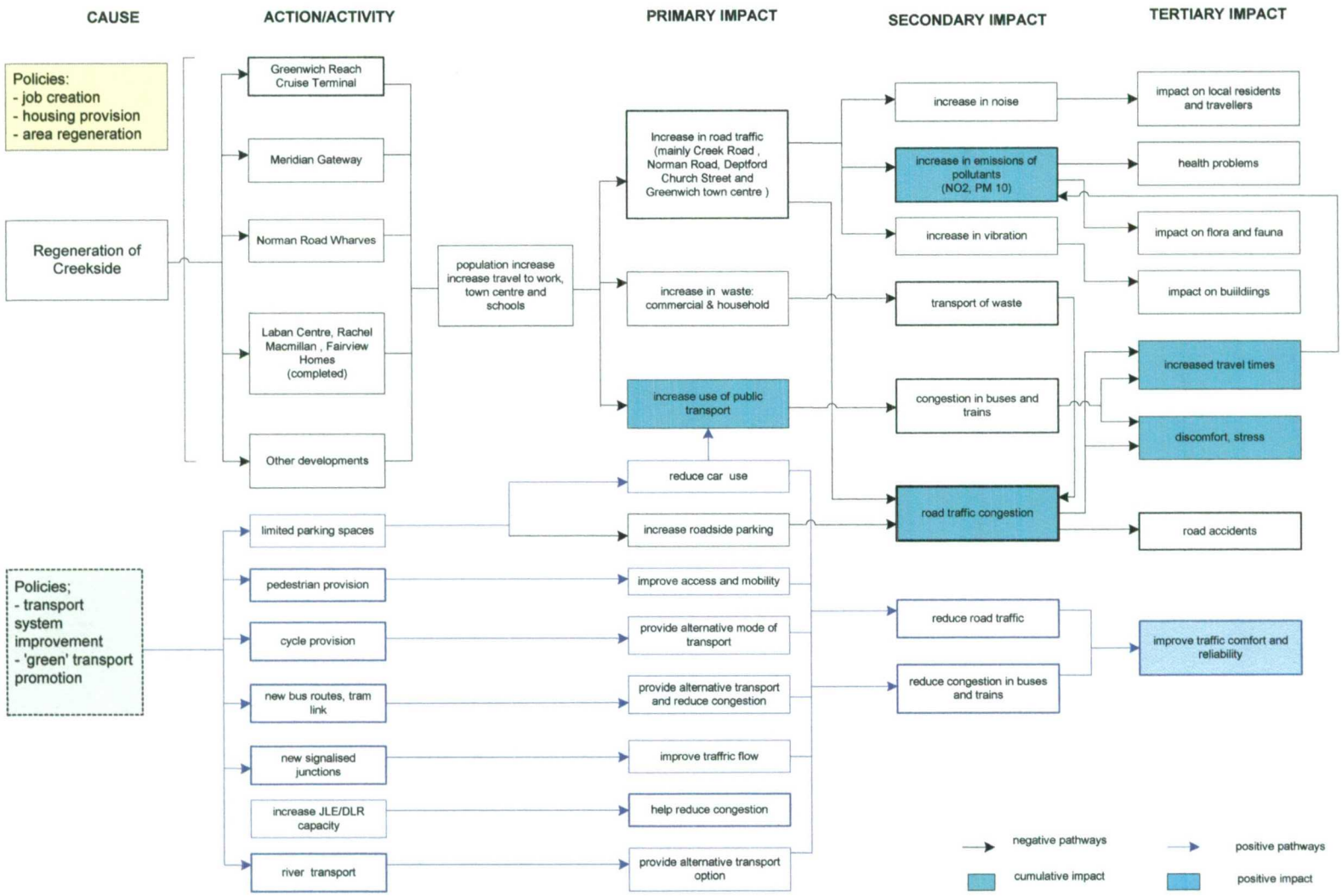


Diagram 10. 7 Transport impacts in Creekside (operational phase)

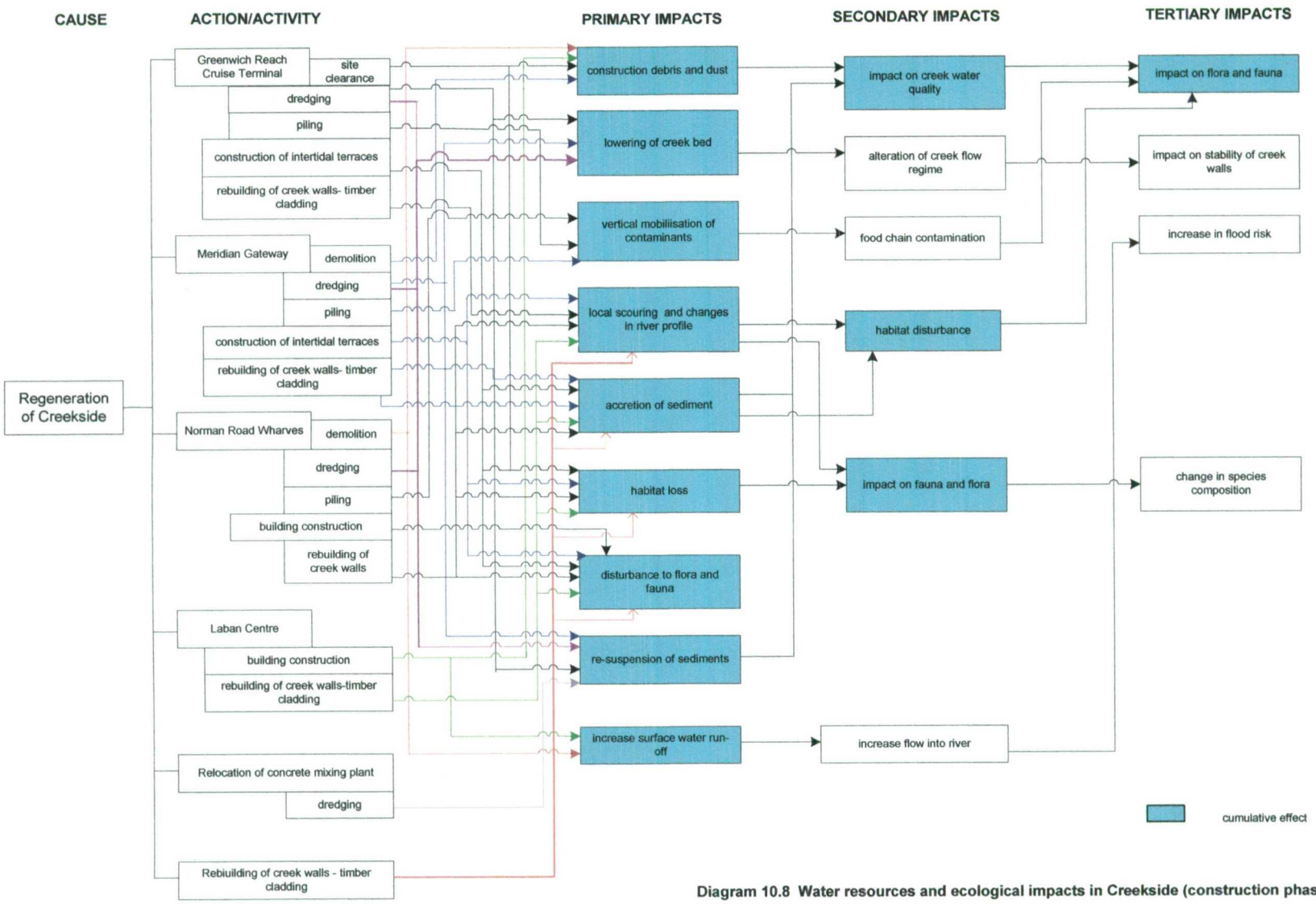


Diagram 10.8 Water resources and ecological impacts in Creekside (construction phase)

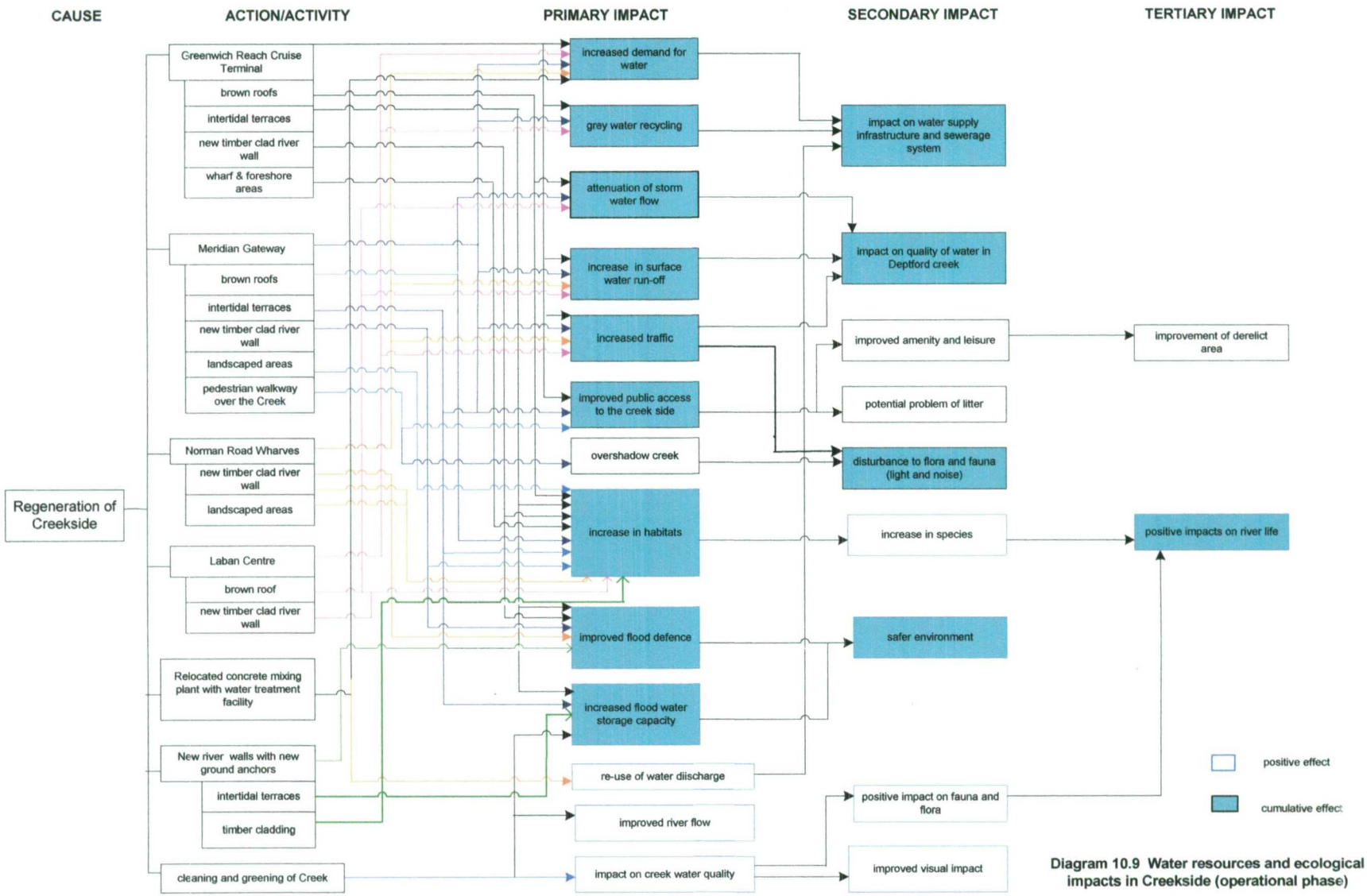
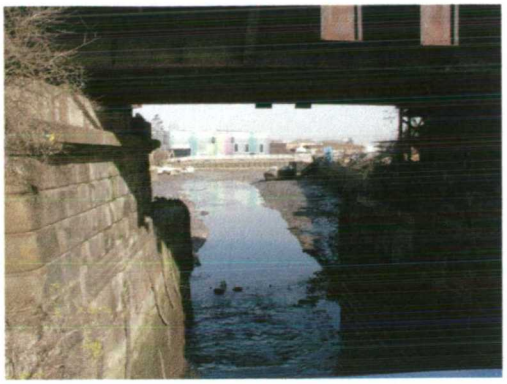


Diagram 10.9 Water resources and ecological impacts in Creekside (operational phase)



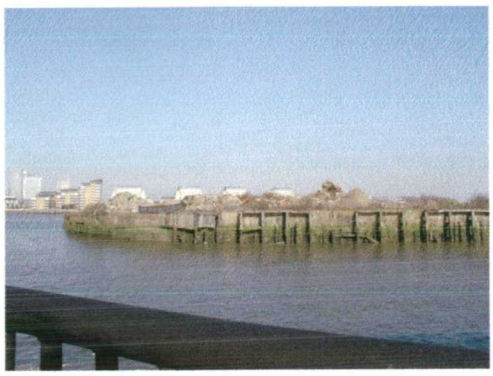
Deptford Creek



Creekside Education Centre



Creekside Area – Haddo Estate and Industrial Units



Greenwich Reach Site



Meridian Gateway Site (left), Laban Centre (right)



Fairview Homes



Creek Road



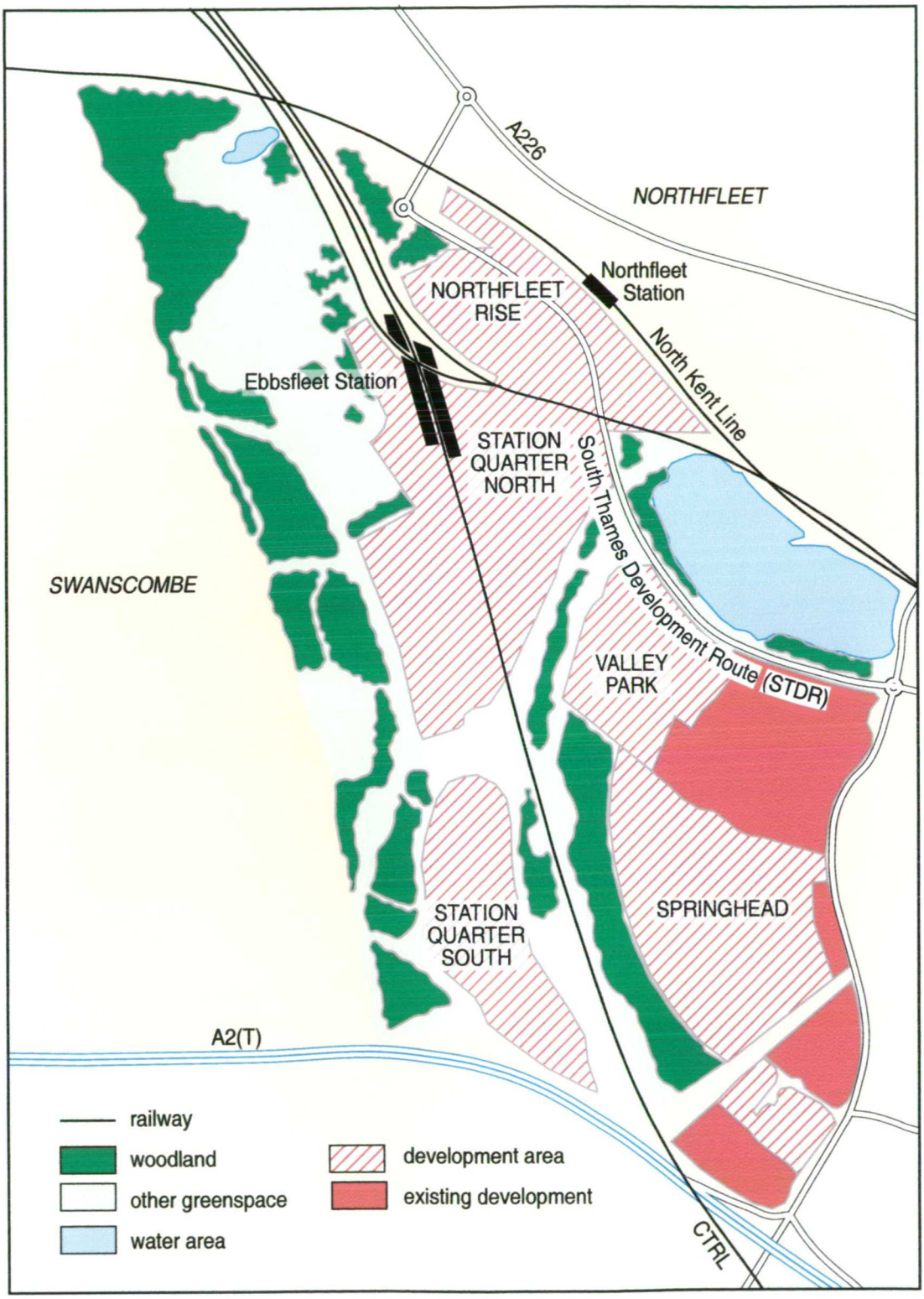
Laban Centre

10.8 Case study 3: Ebbsfleet Developments

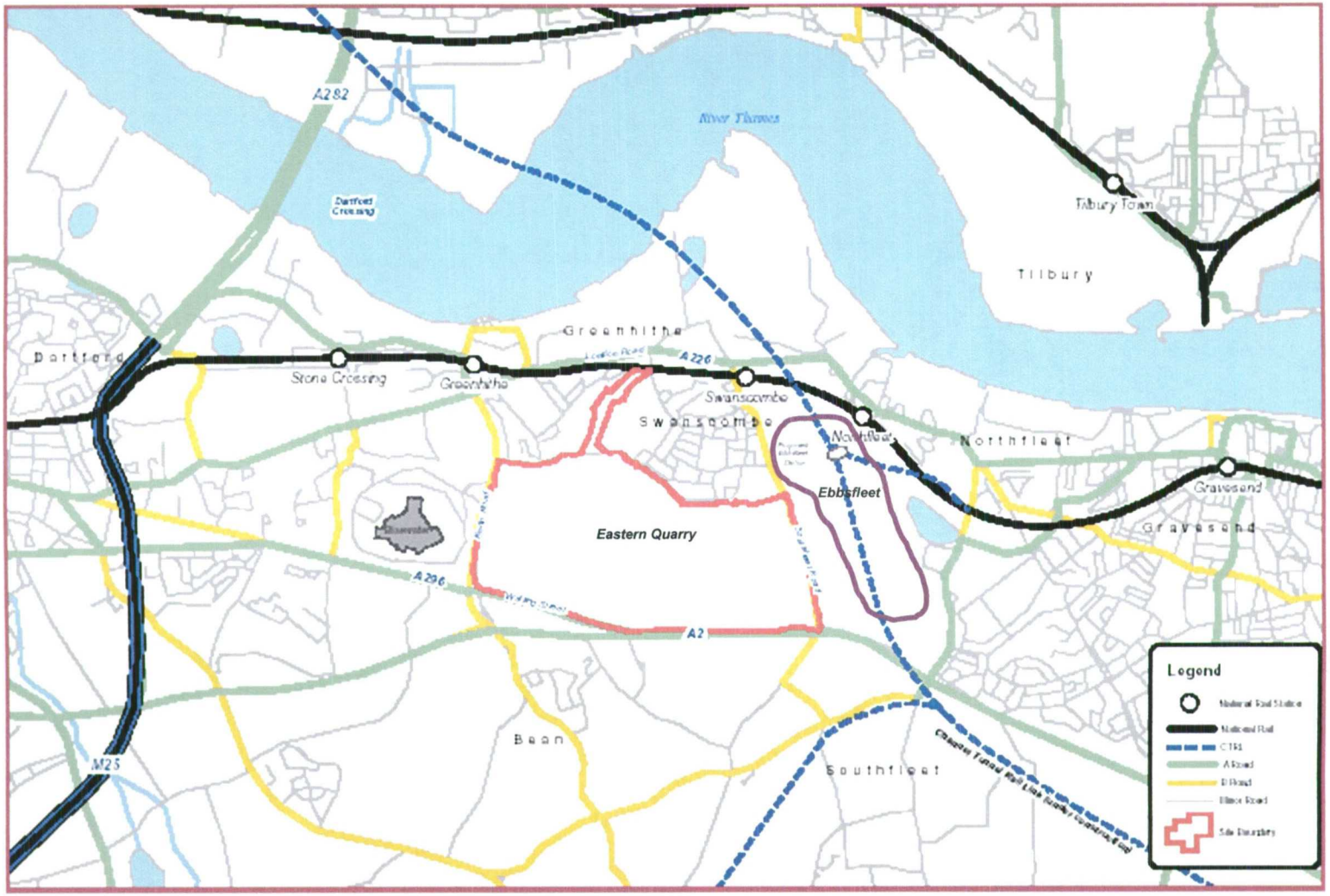
The Ebbsfleet Development and Environment Framework (EDEF) has been prepared by Dartford Borough Council, Gravesham Borough Council and Kent County Council and adopted as Supplementary Planning Guidance through Council resolutions in June 1996. The Framework sets out a number of principles regarding development, community, transport and environmental issues.

The developments in the Ebbsfleet Valley consist of: the CTRL which will enter the valley from a tunnel under the A2 trunk road and cross Ebbsfleet stream towards the west bank of Ebbsfleet; a new railway line connecting the North Kent line with the CTRL; the Ebbsfleet Station and related commercial development and housing. These are indicated in Map 10.4. In addition, transport infrastructure will be provided to integrate Ebbsfleet with other development areas, including Bluewater, Eastern Quarry, Swanscombe Point and Northfleet/Gravesham Riverside. This includes the South Thames-side Development Route to serve development areas and other road links.

The Ebbsfleet Valley lies approximately 30 kilometres east of Central London and 1 km south of the River Thames at Northfleet Hope. It occupies 190 hectares and lies between the Northfleet communities of North Kent, covering areas in Dartford and Gravesham. A large proportion of the area is damaged land, due to extensive chalk quarrying and subsequent land-fill. Ebbsfleet Stream forms the boundary between the local authorities. The Ebbsfleet is a calcareous stream running through areas of reed bed, marsh, rough grassland and scrub. With the Blue Lake, the stream supports an important range of habitats, which is of county importance and has been designated as a Site of Nature Conservation Interest (SNCI). The Ebbsfleet Valley has been widely used by Northfleet and Swanscombe communities for recreation. To the south of the valley, both sides are used for agriculture, which include Grade 1 and Grade 2 agricultural land. There are Scheduled Ancient Monuments and other areas of archaeological interest.



Map 10.4 Ebbsfleet Developments *Source: Dartford Borough Council et al (1996)*



Map 10.4A Kent Thames-side Developments *Source: Modified from Land Securities (2003)*

The Issues

The EDEF identifies cumulative effects that can result from the CTRL proposals and other non-CTRL proposals in Ebbsfleet Valley. The main cumulative effects of concern were on transport, the natural and historical environment and ecology. In particular, these were the effects on:

- existing and proposed infrastructure provision and on adjoining areas, including existing communities;
- the natural and historic environment;
- nature conservation areas in the Valley.

The Ebbsfleet Valley contains features of archaeological and environmental importance. Archaeological resources date from a number of different periods, which are of national importance. Nature conservation concerns the Ebbsfleet SNCI, where reed beds cover an area of about 5 hectares. They are relatively undisturbed in the south of the valley and are recognised as being of great value for nature conservation, particularly because reedbeds are a threatened and decreasing vegetation in England and Wales and very scarce in Kent (Darford Borough Council et al, 1996). The developments will cause temporary and permanent loss of habitats and direct land take, especially from the SNCI. Furthermore, the SNCI will also be affected by fragmentation of habitats, potential pollution effects and increased disturbance during construction and afterwards.

Another important issue is transport. There are a number of transport infrastructure proposals in the area relating to the CTRL and Ebbsfleet Developments. The local authorities encourage the use of public transport, which should be reflected in the density, layout and mix of developments. In addition, the Ebbsfleet Framework specifies that the ***cumulative effect on existing and proposed infrastructure provision, and on adjoining areas including communities*** should be identified and areas where mitigation is needed highlighted (Dartford Council et al, 1996, p. 32).

10.8.1 The Councils' Approach

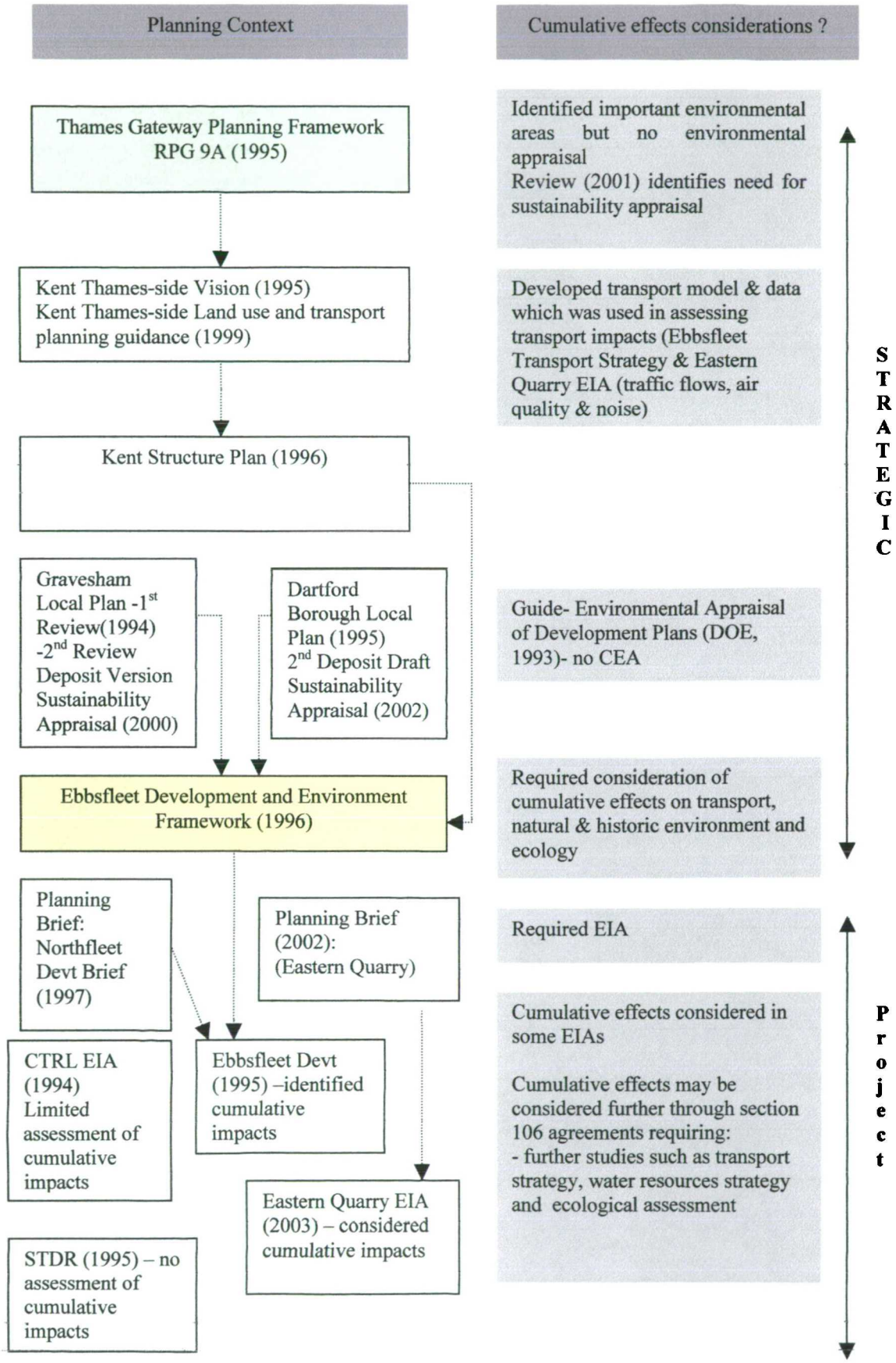
The regeneration plan for Ebbsfleet Valley involved a partnership approach between two local authorities (Dartford and Gravesham) and Kent County Council. The Ebbsfleet Developments form part of the Kent Thames-side area, one of the principal centres for growth identified in the Thames Gateway Planning Framework (RPG 9, 1995). The development of Ebbsfleet Valley has been guided by the strategic

partnership provided by Kent Thameside Association (KTA) Vision (KTS, 1995 and 1999) and the Ebbsfleet Development and Environment Framework (EDEF). The KTA undertook a study on development capacity based on public transport accessibility and developed a transport model[6] for the area. The figures from this model were used in transport noise, and air quality elements in the Ebbsfleet Transport Strategy[7] (subsequently submitted in 2003 as part of the planning permission conditions) and Eastern Quarry EIS. The planning context for the developments in Ebbsfleet is shown in Figure 10.3.

The Councils (Gravesham and Dartford) adopted a strategic perspective of cumulative effects issues in the EDEF which guided development but these effects were assessed during the development control process, supplemented by requiring more in depth strategies on some cumulative effects issues. Although some EISs submitted in the area considered cumulative effects, these were not detailed. As part of the outline planning permission for Ebbsfleet, for example, further transport and ecological strategies were required to be submitted.

[6] Multimodal KTS model – developed in 1993 using SATURN and TRIPS elements to provide an assessment of traffic volumes, public transport patronage and prediction of modal shifts between them.
[7] The outline planning application and EIS for Ebbsfleet was submitted in 1995.

Figure 10.3 Planning Context: Ebbsfleet Valley Developments



10.8.2 Evaluating the Councils' Approach

The approach adopted by the Councils in addressing cumulative effects were compared with the Framework approach and set out in Table 10.12.

Table 10.12 Application of draft framework approach to Ebbsfleet

Criteria	Approach in Ebbsfleet
Clear objectives and guiding principles	The EDEF was clear about requiring that cumulative effects should be addressed in EIAs. It also established principles for sustainable development, transport and the environment.
Integration into the plan-making process	The EDEF has been adopted as Supplementary Planning Guidance by the local authorities in 1996. It was eventually incorporated into the reviews of the Local Plans.
Commitment	The need to address cumulative effects was clearly stated in the EDEF. Furthermore, the EIAs were required to consider cumulative effects relating to the proposals.
Multiple organisation involvement	The EDEF was developed by three local authorities with consultations from the public. The Kent Thameside Vision which set the context for the development of the Ebbsfleet Valley was formulated by representatives from the private and public sectors.
Better understanding of cumulative effects	Other cumulative effects issues have come to light: impacts on utilities and services
Input to strategic planning	Cumulative effects not considered in appraisal of plans
Contribution to decision-making	Development control level

According to the Planning Officers from Dartford (strategic and development control), cumulative impacts on utilities and services are likely to be significant and that assessing cumulative effects at strategic level could help address service provision. The Planning Officer (development control) suggested that these issues should have been considered at a higher planning level, during the preparation of the Thames Gateway Framework. The Officer observed that transport impacts have been addressed through the Kent Thames-side vision and that the planning perspective already deals with the overall effects of developments including minor developments. The Officer argued that the conditions set on planning approvals deals with all effects and that cumulative effects can be addressed in the local plan and through development briefs but it is up to the developers to assess cumulative effects. The Planning Officer (strategic planning-Dartford) commented on the difficulty of addressing cumulative effects in Sustainability Appraisal because it gives no detail, tries to be objective but is really a subjective exercise. In Figure 10.3, CEA could have been undertaken during the preparation of the EDEF. The SAs of the relevant development plans do not address cumulative effects. The SA of the Kent and Medway Structure Plan (2003) mentioned

considering cumulative impacts of transport, employment and housing but did not provide details (see Chapter 6). CEA can be integrated into future SEAs of the development plans.

10.8.3 Evaluating the process for considering effects

This section analyses the approach used by the planning authorities for considering cumulative effects. The EDEF has mentioned that the local authorities expect that cumulative effects to be assessed in EIAs of proposals in the Ebbsfleet Valley. The stage in which these effects were assessed took place during the development control processes. Table 10.13 sets out the case study process as compared to the draft CEA framework. The analysis is based mainly on the Ebbsfleet EIS, the CTRL and the STDR and the planning permission process for Ebbsfleet. These EISs are discussed in more detail in Chapter 6. A more recent EIA, Eastern Quarry has been included in the discussion. Eastern Quarry is adjacent to the Ebbsfleet Valley, being a large development (7,250 homes and non-residential uses (e.g. commercial, community, education, leisure) the combined developments of Ebbsfleet and Eastern Quarry are likely to have potential impacts on the area, particularly on transport.

Table 10.13 Application of the draft framework process to Ebbsfleet

Draft CEA framework process	Ebbsfleet case study process
Scoping: -identify potential cumulative effects issues and VECs; -set appropriate geographical and temporal boundaries; - identify other actions	-Scoping: Ebbsfleet and CTRL: the scope of the EIS was drawn from Schedule 3 of the EA Regulations. The CTRL also categorised effects which included cumulative effects. -Geographic boundaries of EISs limited to area of devts. -Temporal boundaries for EISs: from construction to start of operation. -Existing developments and receptors in the immediate area are identified in EISs. In Ebbsfleet, the cumulative impacts of the project together with some projects (CTRL, STDR) were considered. The CTRL considered cumulative impacts together with the M2 widening.
Baseline conditions: -characterise environment and establish baseline	Baseline information limited to the specific site – Ebbsfleet Valley for Ebbsfleet while the CTRL and STDR considered their respective routes
Assessment of Effects: -identify impact pathways and cause and effect relationships -predict potential impacts -assess of significance	Ebbsfleet: identified causes of some impacts, such as the effect on surface water runoff and groundwater resources; the cumulative impact of Ebbsfleet, CTRL and STDR on archaeology; CTRL and M2 widening and its cumulative effects on transport and ancient woodlands Significance of impacts not fully assessed
Mitigation	Proposed mitigation measures for some cumulative impacts
Monitoring	Monitoring is not dealt with in the EISs but for Ebbsfleet, monitoring schemes are covered in

	subsequent reports
Consultations	Consultations were conducted with statutory and non-statutory organisations

- **Scoping**

The scope for both Ebbsfleet and CTRL included cumulative effects. The Ebbsfleet Development and Environment Framework provided guidance on the scope for the Ebbsfleet EIA. More recently, the Eastern Quarry EIA (Peter Brett Associates, 2003) undertook scoping to identify significant issues including potential interactions and cumulative effects. Like the Ebbsfleet EIA, a series of assessment dates were set to provide different development conditions.

Baseline Conditions

Baseline conditions were established for the sites and surveys (e.g. traffic, habitats) were undertaken. Valued resources, such as water quality and nature conservation sites were identified. Trends relating to important resources were established as well as the regulatory standards. With respect to transport, the data from the KTS model has been used as the basis for air quality, traffic and noise assessments for project EIAs (Eastern Quarry EIA and Ebbsfleet Transport Strategy).

- **Assessment of Effects**

The EDEF identified potential cumulative effects (i.e., transport and ecology) which were further considered in the EIAs. The EDEF noted that detailed work on the environmental effects of the CTRL and Ebbsfleet Station has been undertaken and wished "*to ensure that non-CTRL proposals similarly undertake a detained assessment of effects and specifically address the* ***cumulative impact*** *of their proposals in the natural and historic environment* (Dartford Borough Council et al, 1995, p. 36). Causes (other developments together with Ebbsfleet that are likely to affect resources) and potential effects were mentioned in the Ebbsfleet EIA but were not discussed in detail. The Eastern Quarry EIA considered interactions and cumulative effects relating to the following issues: socio-economic; community facilities; traffic, air quality and noise; air quality effects on ecology; off site effects on water resources; archaeology and historic resources; ecology and nature conservation and landscape and visual impacts. Cumulative impacts matrices were prepared under each heading: natural environment; built environment and human being and society in which possible interactions were identified. In considering cumulative impacts on transport, a number of schemes in the

area were identified, including the components of Ebbsfleet Development. In all these documents, the assessments were qualitative.

- **Mitigation**

The intensive development proposed in Ebbsfleet (790,000m² floorspace in 67 hectares and another 76 hectares of open space), raised the issue of how the development can be serviced satisfactorily by transport. The outline planning approval was granted in 1998 on the basis that no more than 37% of journeys to and from the new development will be by car. At that time it was not certain what combination of uses should make up the final development and this was recognised in the planning approval by the setting of upper and lower levels of permitted development for residential and employment uses. Therefore, alternative development intensities were put forward by the applicant as part of the planning application. To address uncertainties, planning conditions required that further detailed strategies be prepared at various phases of the development. Thus, master plans for each part of the development had to be prepared as well as transport impact studies for that component. The Council therefore took an adaptive management approach towards assessing effects. The Decision Notice for Ebbsfleet (Borough of Gravesham, 1998) stated that no development shall take place within Northfleet Rise Quarter on land which has been identified for environmental mitigation unless appropriate mitigation is provided within the Ebbsfleet Valley. This was to ensure that long term mitigation is provided for the natural habitats and features damaged or lost by the development.

- **Monitoring**

There were no monitoring proposals in the Ebbsfleet EIA but the Decision Notice for Ebbsfleet required that a Joint Monitoring Strategy set out a programme for monitoring the progress of the development, which should include indicators to measure the effectiveness of the transport system and network, environmental mitigation, the impact on air and water quality and social and community provision (Ibid, 1998, p.51)[8]. Condition E1 required an Environmental Management System to be submitted.

Consultations

The EDEF was subject to public consultations in 1996 and the comments received were considered by the three authorities before its adoption as SPG. The EIAs also

[8] A similar decision and conditions were given by Dartford Borough Council.

undertook consultations with statutory and non-statutory organisations but the documentation do not reveal to what extent cumulative impacts were considered in the consultations.

10.8.4 Case Study Conclusions

The local authorities in this case study adopted a partnership approach in addressing the potential effects of development in the Ebbsfleet Valley. They formulated a Vision for the area which was further developed in the Ebbsfleet Development and Environment Framework. In this Framework, they identified cumulative effects that should be addressed in project EIAs. They therefore took a strategic approach to cumulative effects but did not actually assess the potential impacts at that stage. The assessment of cumulative effects was therefore undertaken during the development control process, through EIAs. As a result of the approach taken by the planning authorities, the main outcomes of the case study were:

- The assessment of cumulative effects of developments in Ebbsfleet was largely inadequate since some EIAs did not address cumulative effects, others only addressed some aspects and not all relevant developments were considered;
- Mitigation measures for cumulative effects were limited to planning conditions and were therefore reactive;
- Project proposals were approved although overall impacts had not been assessed thoroughly. Instead, planning conditions required that proponents undertake further detailed studies on some aspects, such as transport and ecology. This approach, however, is piecemeal and did not provide an overall picture of cumulative effects;
- There was no follow-up mechanism for cumulative effects;
- Although strategic studies for the Kent Thameside area examined potential environmental impacts of developments in the Ebbsfleet Valley on transport and green spaces, these did not assess cumulative effects.

Application of the CEA Framework would have improved planning in this case study in several ways. The CEA would have provided decision-makers with information on the potential effects of development options for the area based on a well structured analysis. A more effective planning process would have resulted in that an early, systematic assessment of effects would have meant more attention to effects, including indirect effects. All relevant developments, including minor actions not covered by EIA, would

have been considered. Strategic policies for mitigating potential effects could have been identified. The CEA framework would have provided a mechanism whereby the results of the assessment were fed back into the planning process, which would have been useful in future plan revisions. The monitoring programme proposed in the CEA Framework would have provided valuable information on valued resources, which could have been used in assessing additional impacts from proposed developments. Thus, the results of the CEA would have informed the preparation of EISs and the development control process so that delays and costs reduced. A summary table of the aspects where the CEA Framework would have improved the case studies is presented in Table 11.5.

10.8.5 Applying the network analysis method

To understand cumulative impacts relating to the Ebbsfleet developments, impacts were identified and characterised. In addition, consultations were undertaken with stakeholders to define cumulative effects issues and help refine the initial network diagrams. Diagram 10.10 shows the overall impacts relating to the transport infrastructure and developments in the area: CTRL, STDR and Ebbsfleet Developments and the proposed Eastern Quarry. Focusing on Ebbsfleet Development (housing, commercial, related community facilities and the International and Domestic train station), the impacts and interactions from these various components are drawn up in Diagram 10.11.

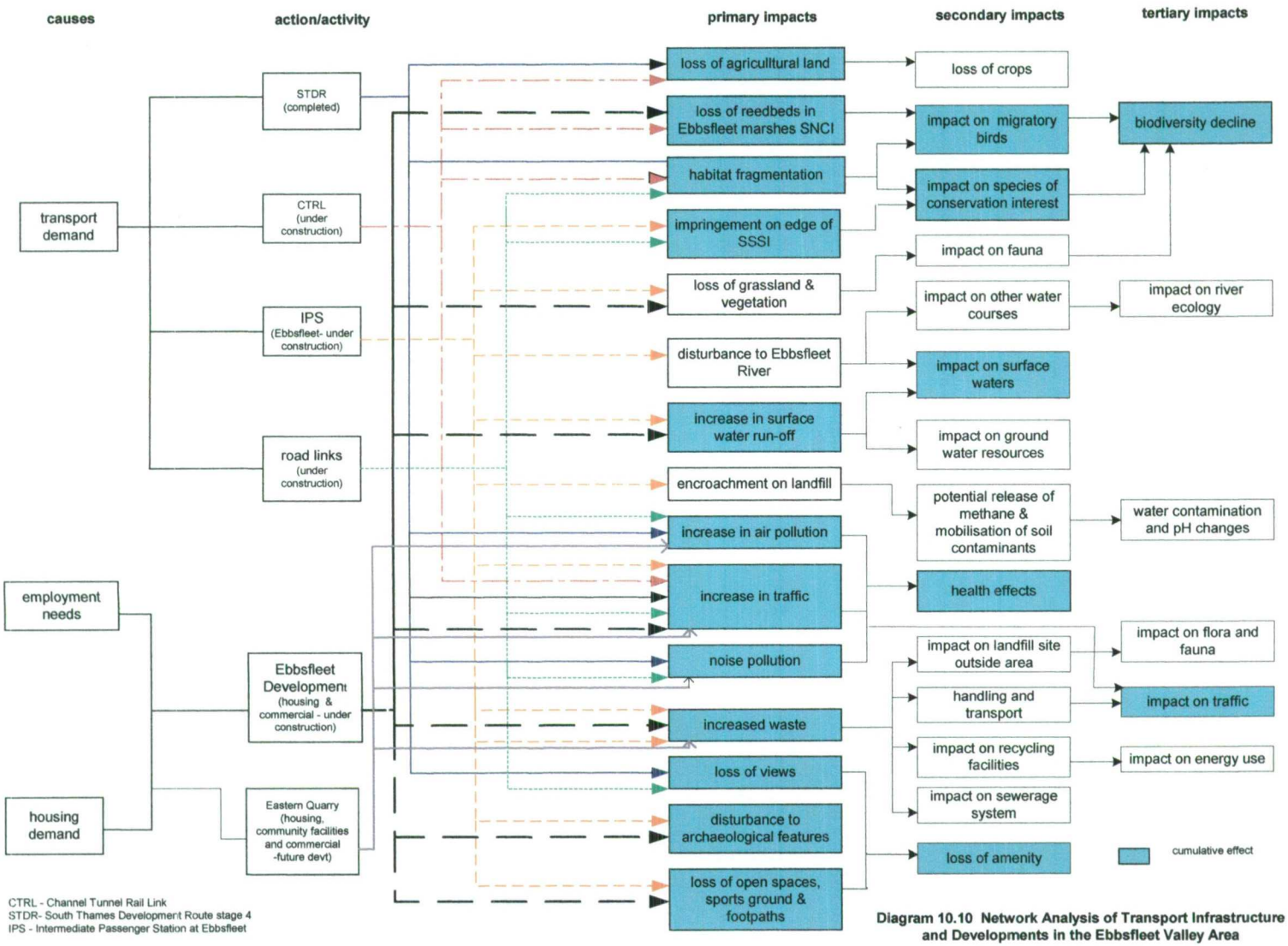


Diagram 10.10 Network Analysis of Transport Infrastructure and Developments in the Ebbsfleet Valley Area

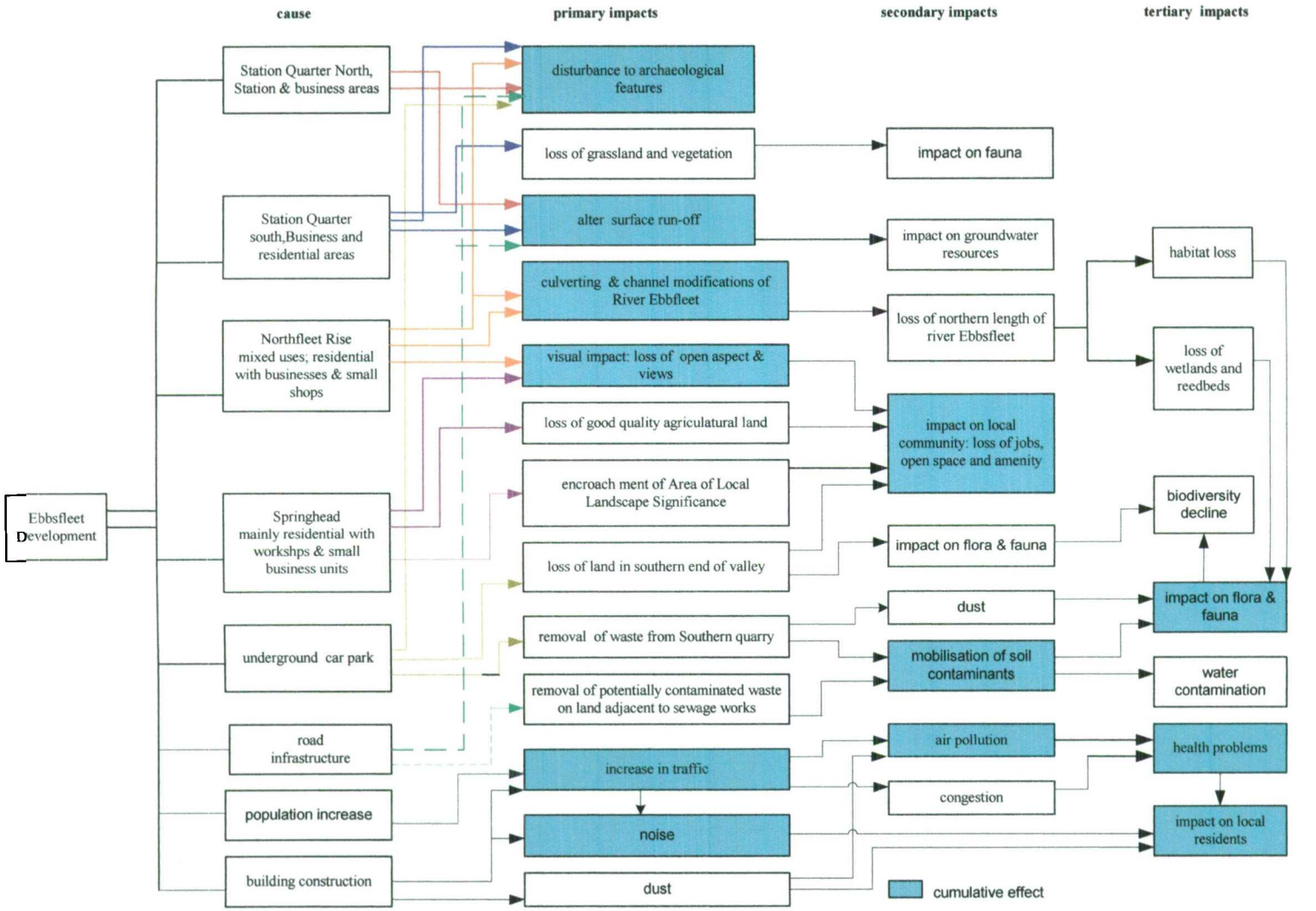


Diagram 10.11 Network Analysis of Ebbsfleet Development

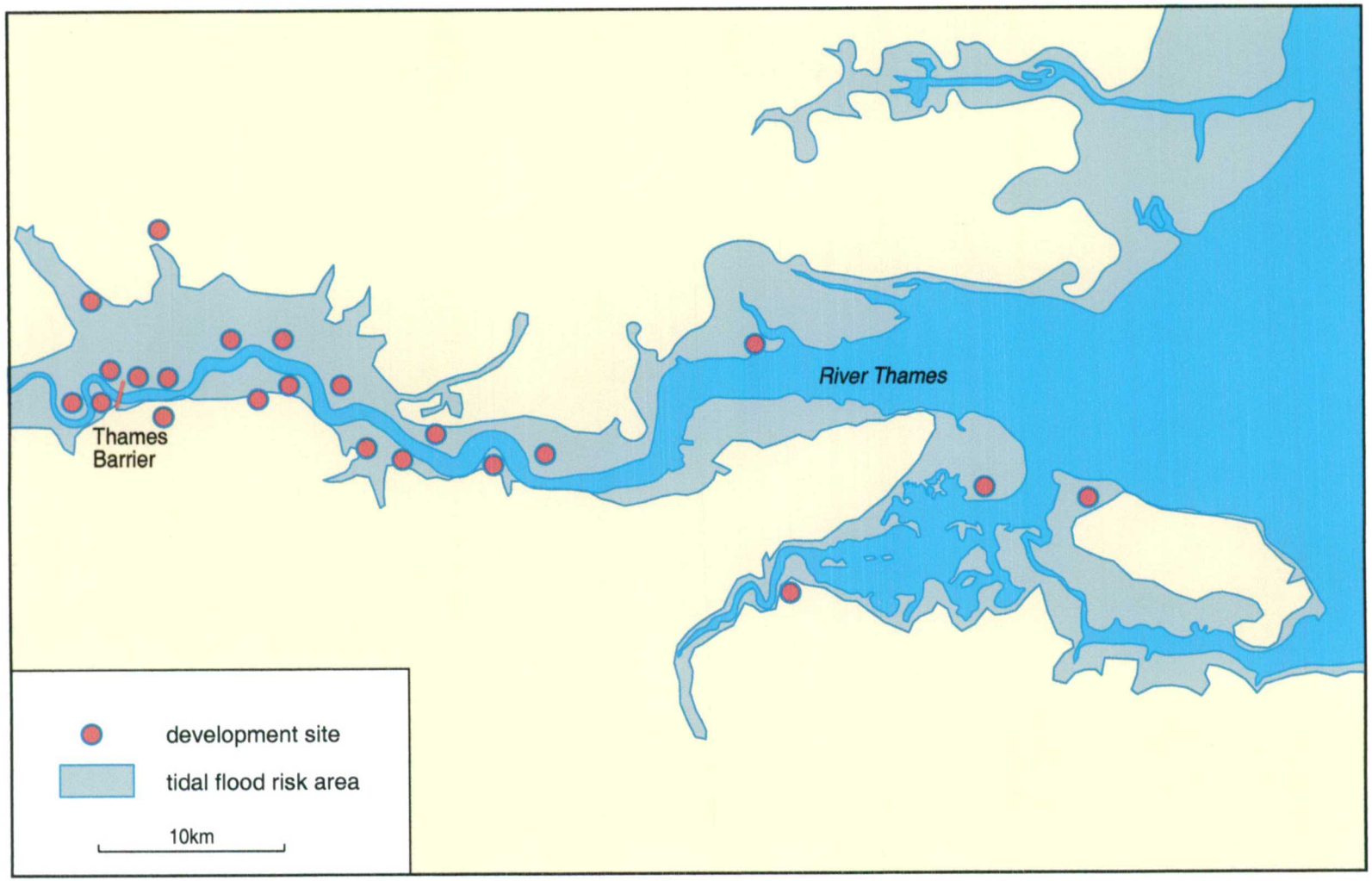
10.9 Case study 4: Thames Estuary Flood Risk Management Plan

Background

This case study involves the application of the draft framework to a management plan at a regional scale. The management plan focuses on one type of cumulative effect: flooding. The strategy to regenerate the Thames Gateway where major development sites have already been identified along the linear corridor of the tidal Thames and eastwards along both shores of the estuary will have major impacts on the environment of the Thames Estuary. As the area becomes built up and open spaces covered with concrete or other impermeable surfaces, surface water run-off is likely to increase, which in turn could contribute to flooding in the area. Many developments have already been completed and some are under construction. Many of these developments include residential areas, which are mostly in or close to the area at risk of tidal flooding (Parker and Penning-Rowsell, 2002). The value of property and numbers of people potentially at risk are already large, but these are set to increase due to future developments (Ibid, 2002). The flood plain and proposed development sites are indicated in Map 10.5.

The Thames Estuary Flood Risk Management Plan (TEFRM) Plan is being developed by the Environment Agency to address the management of the Estuary for the next 100 years. It is a combined initiative by the three Agency Regions (Anglia, Southern and Thames). Started in 2002, the preparation of the plan is expected to take six years to complete and implementation is likely to be between 2015-2040. The strategy area covers the natural tidal floodplain from Teddington in West London to a downstream limit approximately from Sheerness to Shoeburyness and the Isle of Grain. The part of the study area in the Thames Gateway is shown in Map 8.1. The area is currently protected to a high standard by the Thames tidal defences but a major tidal flood could have serious consequences (Environmental Agency, 2003b). The existing flood defences of the tidal Thames, the tidal reaches of its tributaries and the Thames Estuary, will begin to fall below the standards considered appropriate around 2030 (Environment Agency, 2003b).

The key drivers for the development of the TEFRM Plan include the socio-economic pressures for development in the area, the ageing flood defence infrastructure, the need to plan for the impacts of climate change, and compliance with environmental legislation (the EU Habitats and Birds Directive, the Water Framework Directive and the SEA and EIA Directives) (Environment Agency, 2003b).



Map 10.5 Development Sites and Flood Risk Area – Thames Gateway

Source: Based on DETR (2001) and Environment Agency (2002)

In developing the TEFRM Plan, an integrated, strategic approach was adopted in order that all the pressures and drivers affecting the estuary can be identified. A risk based perspective and 'whole society' approach, with the engagement of key stakeholders including those involved in the Thames Gateway developments (Environment Agency, 2003b). During the Project Inception phase, workshops, scoping and consultations were carried out. The preparation activities examined four options: 1) Do nothing (apart from minimum statutory requirements); 2) Continue Long Term Planning on an Individual Regional Basis (the estuary is covered by three agency regions-Southern, Anglian and Thames); 3) Integrated Approach to Flood Defence; 4) Integrated Approach to Flood Risk Management.

The recommended option was Option 4, which adopts a proactive, strategic approach to managing the defences based on a better understanding of estuary processes and effects of climate change. In particular, it will improve understanding of the risks to existing and proposed assets (natural and built environment) currently and in the future. Under Option 4, there are four flood risk management options that have been identified:

- Increased frequency and prolonged closure of the Thames Barrier;
- Promotion of flood compatible uses in flood risk areas;
- Raising the defences;
- Realigning the defences.

The study is in five phases:

1. Scoping and Strategy Framework Development
2. Strategic sectoral studies
3. Development of options
4. Option selection and policy development
5. Flood risk management strategy

10.9.1 Planning authority's approach: SEA of the TEFRM Plan

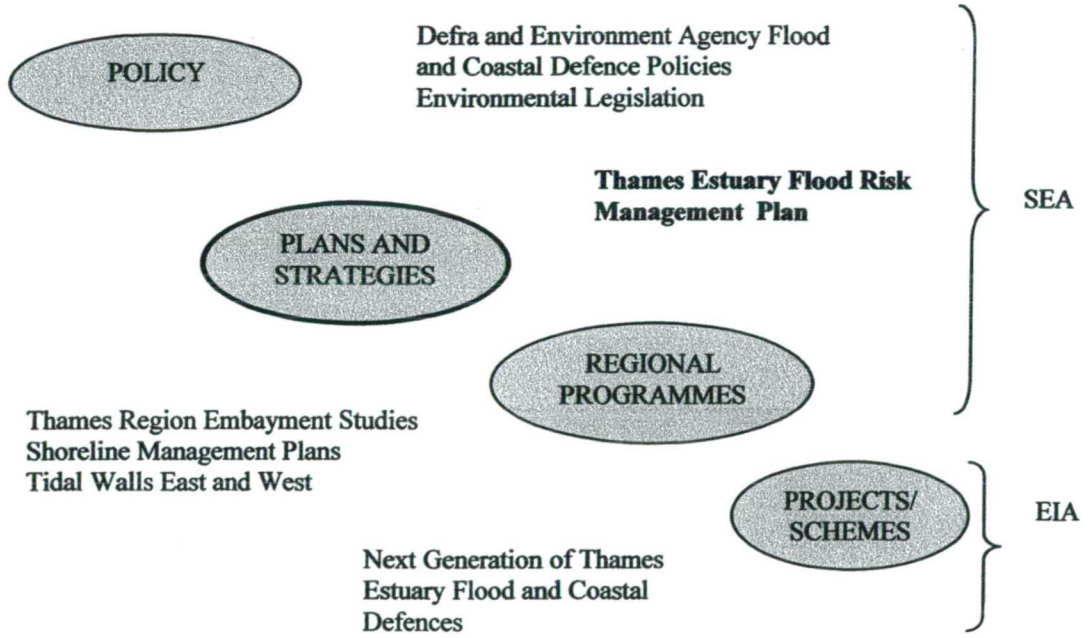
The approach adopted to address environmental impacts is to undertake an SEA of the TEFRM Plan. The SEA process is an integral part of the Project Plan and it will be followed by EISs for each of the strategy options. These studies cover environmental and social effects. An SEA Draft Inception Report was completed in November 2002 and updated in December 2003. The Study is currently in Phase 2.

The SEA will address a number of strategic requirements, which include the following:

- Strategic Environmental Assessment Directive
- Appropriate Assessment (Habitats and Birds Directive)
- River Basin Management Plan (Water Framework Directive)
- Sustainability Appraisal

It will spread over several levels of policy framework and strategic decision-making down to the project level so that environmental considerations are integrated into all tiers of decision-making. Figure 10.4 shows the SEA and EIA policy and procedures in the Environment Agency.

Figure 10.4 SEA and EIA Policy and Procedures (Environment Agency, Draft AMS in Environment Agency, 2003b)



In addition, the SEA will provide the overarching framework for all environmental considerations and consist of:

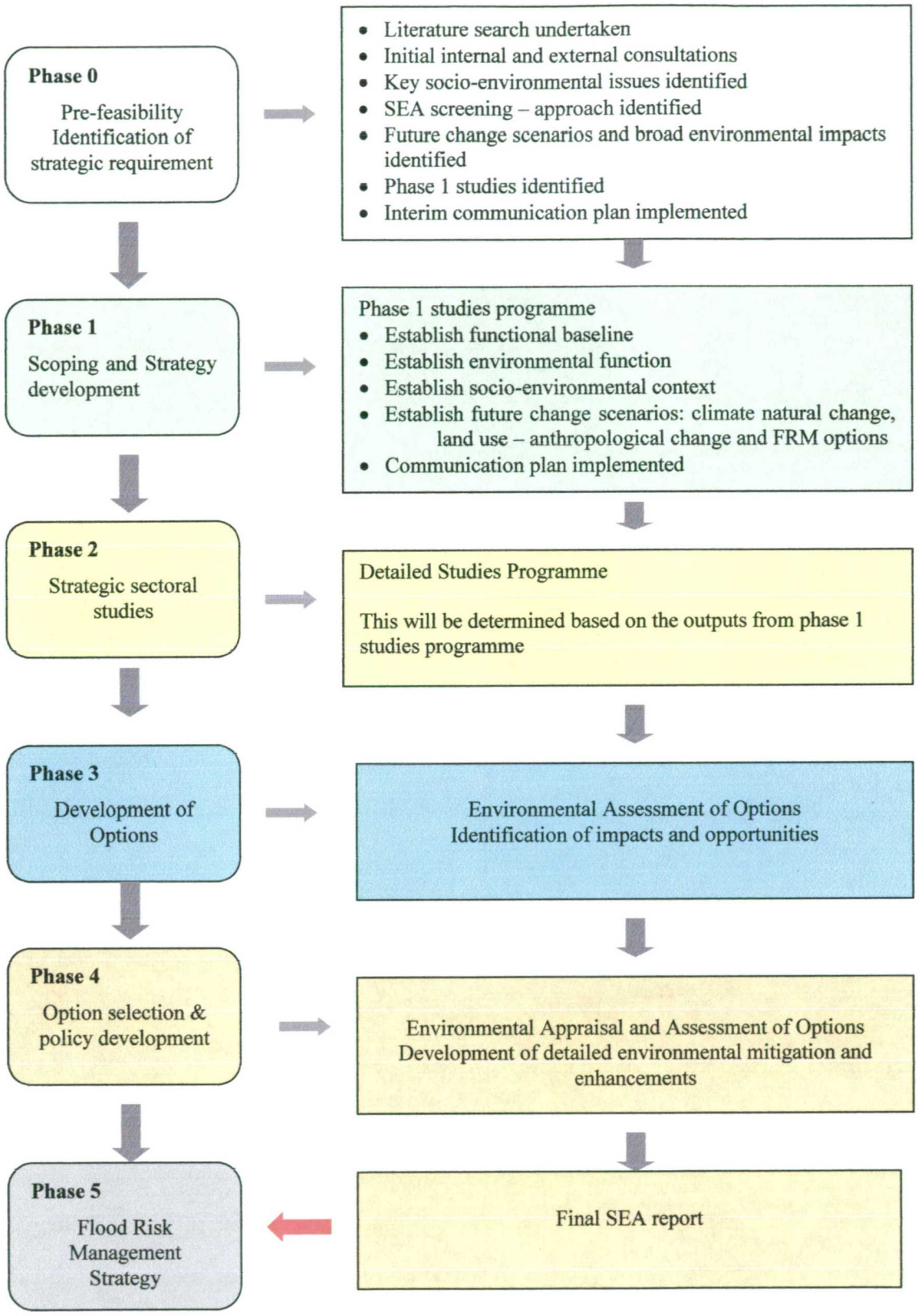
- Sustainability appraisal
- Studies programme and habitats inventory
- Strategic environmental appraisal

The SEA Process is set out in Figure 10.5 and the Sustainability Appraisal (SA) Process is shown in Figure 10.6. The purpose of the SA is to test the performance of the plan and provide the basis for adjustment and the implementation of improvements. The SA

process will be built into the SEA process by aligning steps, activities and milestones. A set of sustainability criteria and indicators for assessment of future plans will be identified and developed throughout key phases of the project. A Cumulative Environmental Appraisal (CEAp) of option selection and policy development will be carried out at phase 4 of the project phase. This will be undertaken in order to assess whether the preferred option is likely to cause significant contributions to cumulative impacts (Environment Agency, 2003c).

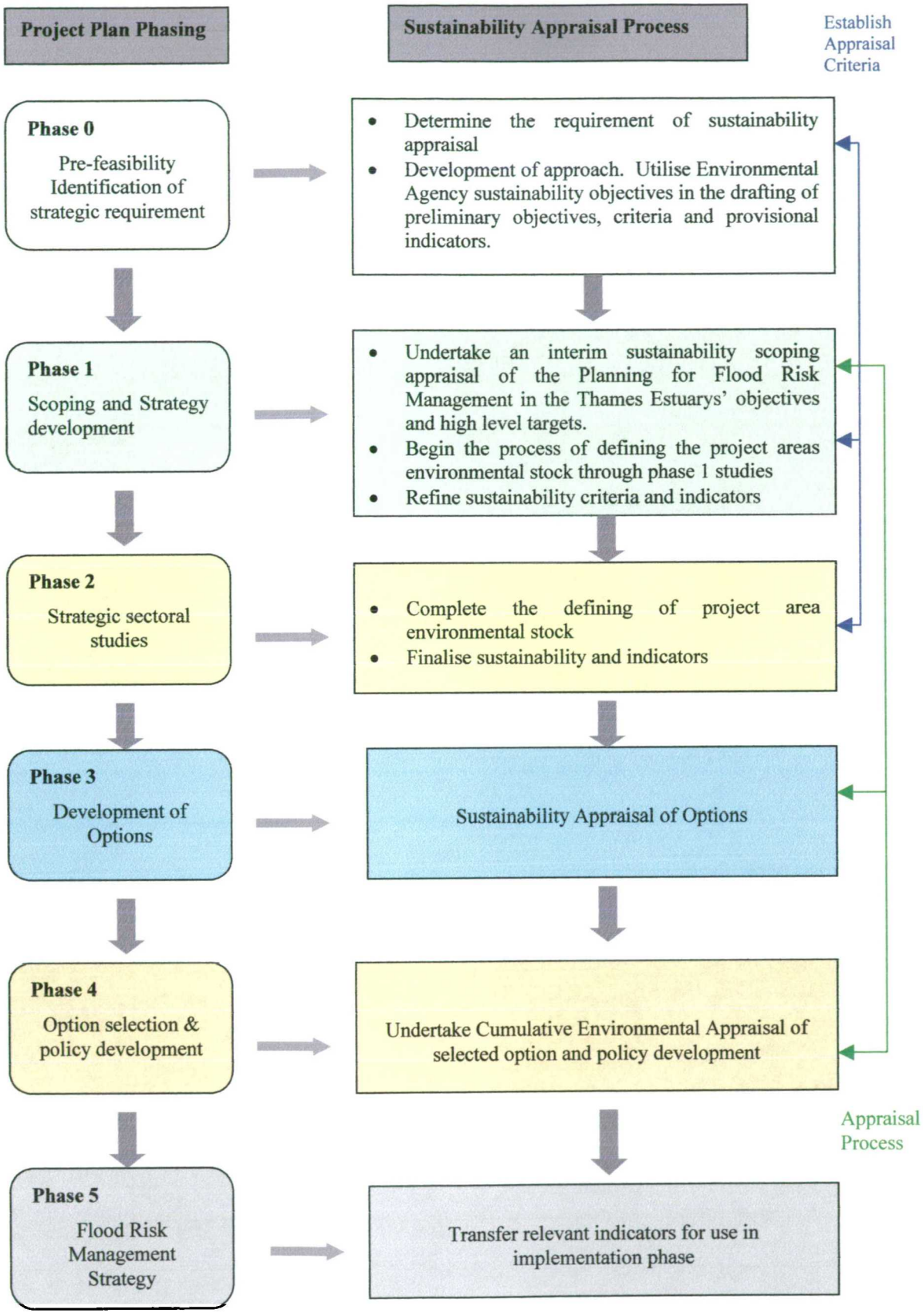
A core of sustainability indicators (economic, social and environmental) will be utilised along with a list of significant criteria. An initial set of sustainability criteria has been developed and these are set out in a matrix. A final set of indicators will be derived from the Agency's corporate strategy *Making it Happen*, the UK Government indicators of sustainable development and some regional and local indicators (Environment Agency, 2003c).

Figure 10.5 The Thames Estuary Flood Risk Management Plan SEA Process



Source: adapted from Environment Agency, 2003c

Figure 10.6 Thames Estuary Flood Risk Management Plan Sustainability Appraisal Process



Source: Environment Agency, 2003c

10.9.2 Evaluating the planning authority's approach

As indicated in Figure 10.6, the assessment of cumulative effects will be undertaken during the option selection. Its role will be to assess the cumulative impact of the selected option and policies. In Table 10.14, the approach is compared to the Framework approach.

Table 10.14 Application of draft framework approach to the TEFRM Plan SEA

Criteria	Planning authority's approach
Clear objectives and guiding principles	The SEA of the TEFRM Plan had clear environmental objectives
Integration into the plan-making process	The SEA/SEA were integrated into the plan-making process
Commitment	SEA/SA undertaken as part of plan preparation
Multiple organisation involvement	Stakeholders involved in scoping
Better understanding of cumulative effects	-
Input to strategic planning	CEAp will input into the selection of options
Contribution to decision-making	CEAp will inform on whether the preferred option is likely to cause significant contributions to cumulative impacts

The sustainability appraisal will use of a range of tools and a systems approach (Environment Agency, 2003c). A major element of the approach to the development of the TEFRM Plan and the SEA is the involvement of stakeholders in the Estuary. Environment stakeholders include statutory and non- statutory organisations.

The strategic approach was based on the Flood and Coastal Defence Project Appraisal Guidance (MAFF, 2000). A CEAp is undertaken in phase 4 of the SEA/SA process, which is integrated into the planning process. The Habitats Specialist and Strategist suggested that the requirements for a CEAp should be considered earlier on in the process. But as the SEA Officer commented, CEAp would be appropriate at the option selection stage where it would be used to inform on the potential impacts of the preferred option.

The approach taken will likely improve understanding of the estuary processes, functions and key drivers that may result in environmental change. This in turn should help improve understanding of cumulative effects.

There are significant differences between the project team's approach and the Framework. The team plans to undertake a cumulative effects appraisal of the preferred option, which suggests that the effects will be assessed against sustainability objectives.

10.9.3 Evaluating the process for considering cumulative effects

The process is compared with the draft Framework in Table 10.15.

Table 10.15 Application of the draft framework process and the TEFRM Plan

CEA process	SEA/SA process of the TEFRM Plan
Scoping: -identify potential cumulative effect issues and VECs; -set appropriate geographical and temporal boundaries -identify other actions	-Scoping identified direct and indirect effects of flood losses. -Valued resources include humans, natural heritage, built environment, utilities and economic resources. -The study area is wider than the strategy area, covering the whole Thames River basin -The Plan period is for the next 100 years -other actions identified: future planned development in the Thames Gateway & other plans (CFMP), (CHMP) -other considerations; climate change, land use/management change
Baseline conditions: -characterise environment -establish baseline for VECs	Environmental context established: natural, heritage and socio-economic environments Habitats inventory, archaeological inventory, surveys
Assessment of effects: -identify impacts, pathways and cause and effect relationships; -predict potential impacts -assess significance	Identified impacts from flooding, indirect and direct; primary, secondary and tertiary effects -modelling of estuary processes -model to test different management strategy options
Mitigation	Policies and management plan
Monitoring	-
Consultation	Consultation with Estuarine stakeholders

- **Initial Scoping**

During this phase, studies and initial scoping of the project plan was undertaken. The issues associated with flooding were explored and the problem defined. The environmental context for the study was established, covering natural, heritage, socio-economic and political environments. Important environmental resources were identified, which included sites designated under the Habitats and Birds Directive, Sites of Special Scientific Interests and World Heritage sites. Environmental resources were characterised and past surveys and research were analysed to identify further research requirements. The lack of data on trends, such as those on the composition of habitats and species was identified. Other actions relating to the area include plans and strategies for the management of the Thames Estuary and proposals for major future developments in the Thames Gateway. Plans that have been produced and those currently being prepared have to be taken into consideration, which include Thames Tidal 'Embayment' Strategies, Catchment Flood Management Plans and other plans and strategies from the three Regions in the study area.

It was during this stage that SEA models were identified from which a combination of SEA models was selected for the project. SEA is seen as the application of EIA to strategic tiers of decision-making, a tool for selecting options with acceptable environmental impact.

The area of land at risk from flooding and the different land uses within the indicative flood plain were identified. The existing flood defence policy framework and other policies set out in other plans, national and international legislation relating to the area were set out. Other relevant plans and strategies for the management of the Thames Estuary and proposals for major future developments in the Thames Gateway were identified. Plans that have been produced and those currently being prepared which will have to be taken into consideration include Thames Tidal 'Embayment' Strategies, Catchment Flood Management Plans and other plans and strategies from the three Regions in the study area.

The SEA Draft Inception Report (Environment Agency, 2002) was prepared during this phase in order provide a framework and integration of environmental considerations within the TEFRM Plan.

- **Scoping**

During this phase, the preferred option, Integrated Plan for Flood Risk Management was scoped in detail. Key environmental issues were identified during this stage. Studies were undertaken to establish environmental context and key drivers. During this stage, initial sustainability criteria were defined.

- **Baseline Conditions**

Instead of determining a baseline for the study, a functional environmental approach has been established. This approach takes account of the current environmental context, particularly the state of ecological recovery of the estuary, the lack of survey/research information and the changing nature of the estuary (Environment Agency, 2003b). A functional environmental approach means examining the influences on the existing and future environmental context. These influences include the following:

- environmental function (physical processes, habitat and species behaviour)
- key drivers (legislative objectives, biodiversity targets and incentives) and
- future change scenarios (climate change and land use/management)

- flood defence response to changes in climate and assets at risk.

Available information from surveys and research has been identified, as well as additional surveys that would be required. Other actions that were considered included relevant legislation, government guidance, plans and strategies. Important resources and statutory nature conservation designations have been identified. An inventory of nature conservation, cultural heritage and socio-economic resources will be developed and environmental objectives established. Habitats and archaeological inventories will be conducted in Phases 1 & 2. Collection and assessment of CASI and Landcover data including review of aerial photography/photogrammetry will be undertaken to establish environmental context. For the SEA/SA, the project area environmental stock will be defined.

- **Assessment of Effects**

During Phase 2, strategic sectoral studies will be undertaken. Initially, a qualitative model of estuary processes which takes account of the morphology, sediment dynamics, hydrodynamics, water quality, ecology and human activities and how these interact will be developed. This model will be refined to incorporate findings from further studies. A flood risk management intervention model will be developed for the Thames tidal defences. This model will be used to test the different flood risk management strategy options.

During phase 3, the options identified in phase 2 will be further investigated and further modelling studies will be conducted. The sustainability appraisal of options developed during phase 3 will be undertaken. During phase 4, these options will be appraised using multi-criteria analysis. For the SEA/SA, a Cumulative Environmental Appraisal will be undertaken to assess the cumulative impacts of the selected option and policies.

- **Mitigation**

A Mitigation Action Plan will be prepared in Phase 1 of the project. Mitigation measures include changes in legislation. Options for management of flood risk, such as managed alignment and zoning development will be considered. Regulation of development in high risk areas, use of high risk areas for flood tolerant uses or changes in the way that properties are constructed so that they are more flood resistant are some of the mitigation measures that will be examined.

- **Monitoring**

A post project appraisal may be undertaken by either the Agency or DEFRA.

- **Consultations**

Early dialogue and partnership with stakeholders, most importantly, Thames Gateway strategic planners and developers were undertaken during scoping. The stakeholders will be actively involved in the decision-making process and their agreement to the framework secured. Environmental stakeholders include statutory and non-statutory organisations.

10.9.4 Case Study Conclusions

This case study takes a strategic approach to appraising the impacts of the Management Plan. However, the SEA Reports (Environment Agency 2002 and 2003c) state that the overall approach is that of SEA where SA will be built into the process. The 2003 SEA report states that the appraisal will use sustainability criteria for appraising the impacts of the Plan. A Cumulative Environmental Appraisal (CEAp) will be undertaken during Phase 4 in order to assess the impacts of the preferred option, so that the option with least significant environmental effects can be chosen. The main outcomes of this case study were:

- Valued resources with potential for cumulative effects and baseline studies and trends have not been established during the early stages of the planning process, including the stage where studies were undertaken;
- Criteria for determining significance of cumulative effects have not been defined;
- Adapting a Sustainability Appraisal approach did not address cumulative effects effectively since SA appraises effects on objectives while CEA requires assessment against the baseline conditions of the receptors;
- Consideration of cumulative effects will occur at a late stage in the planning process.

Application of the proposed CEA Framework would have improved the case study by providing relevant information for decision-making in a timely manner. By applying the Framework, this case study would have conformed to the established principles in CEA and therefore would have been more effective in addressing cumulative effects. Cumulative effects would have been identified early in the planning process and the

baseline conditions and trends for affected resources established. It would have been possible then to assess additional effects from the Plan and other relevant plans (such as urban regeneration development plans) on the valued resources. The Framework would have provided a systematic process for addressing cumulative effects, including direct, indirect and residual impacts. Furthermore, the Framework would have provided a feedback mechanism through the monitoring programme of effects. In terms of efficiency, application of the Framework would have meant having appropriate data, method and criteria for assessing the cumulative effects of options in Phase 4. The baseline data, if established in the first place, which would have been useful to subsidiary project EIAs in assessing their contribution to cumulative effects, thus reducing time and costs. A summary table outlining the improvements to case studies if the Framework had been applied is included in Table 11.5.

10.9.5 Applying the network analysis method

In this case study, the root causes, pathways and impacts, which lead to the cumulative effect of flooding are identified. Some factors which increase the risk of flooding in London and the Thames Estuary are: the impact of climate change, increase in sea level rise, the ageing flood defences and development proposals (housing and commercial) in the area (Environment Agency, 2003b).

Flooding is normally due to catchment-wide hydrological processes and it is the cumulative effect, which is not being addressed in flooding-focused development control policy (White and Howe, 2002). A strategic approach to the problem is therefore required. Flooding is a result of the cumulative effect of activities that combine in an additive manner, not synergistic. A direct cause of flooding in the Thames Estuary may come from storm surges in the North Sea and the inability of ageing flood defences to cope. Indirect causes stem from climate change, sea level rise and increased flows from the Thames catchment and other rivers discharging into the Estuary, which may affect the effectiveness of flood defences. Another indirect cause is the proposed developments in the Thames Gateway to be located in the eastern side of the Thames, which could result in 'nibbling effects' or gradual loss of tidal flood plain areas.

In developing the network diagrams, information from the TEFRM Project Appraisal Report (Environment Agency, 2003b), the SEA Inception Reports (Environment

Agency, 2002 and 2003c) were reviewed to identify causes and important resources likely to be affected by flooding. In addition other documents relating to the baseline environment (Environment Agency, 1998 and Environment Agency, 1999 and Thames Estuary Partnership, 1999) were examined. The effects to be included in the diagram were determined on the basis of a typology of flood losses prepared for the TEFRM Plan project (Parker and Pennington-Rowsell, 2001). This typology lists principal types of flood losses, such as tangible direct and indirect losses and intangible human and other losses as well as primary, secondary and tertiary effects relating to these losses. Cumulative effects can result from the additive effects of these flood losses, such as the combined effect of damage to buildings and infrastructure on the quality of the environment. Diagram 10.12 shows the causes and potential impacts of flooding in the Thames Gateway. Diagram 10.13 sets out the flood risk management options and their potential impacts.

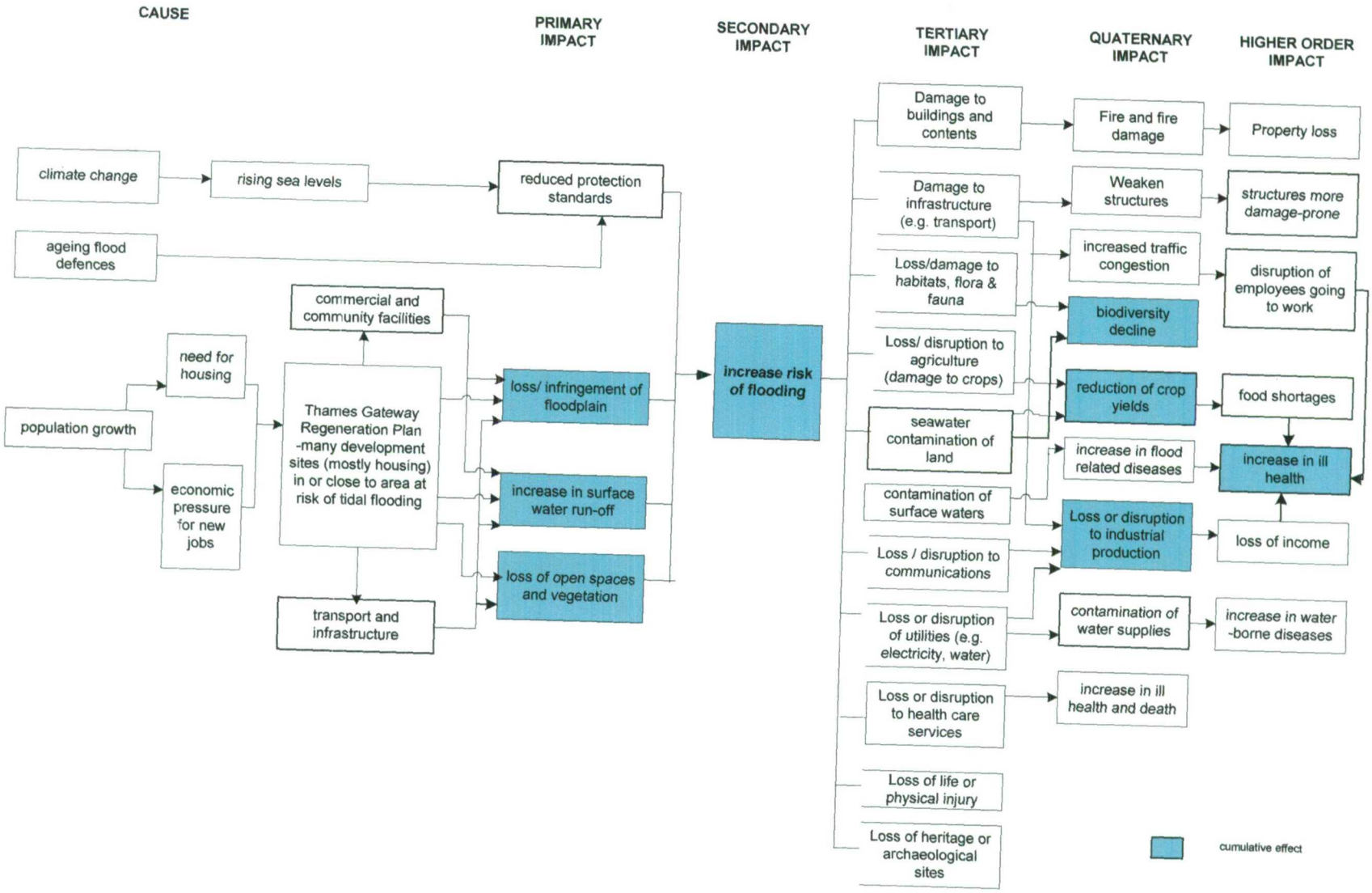


Diagram 10.12 Flooding in the Thames Gateway: causes, pathways and effects

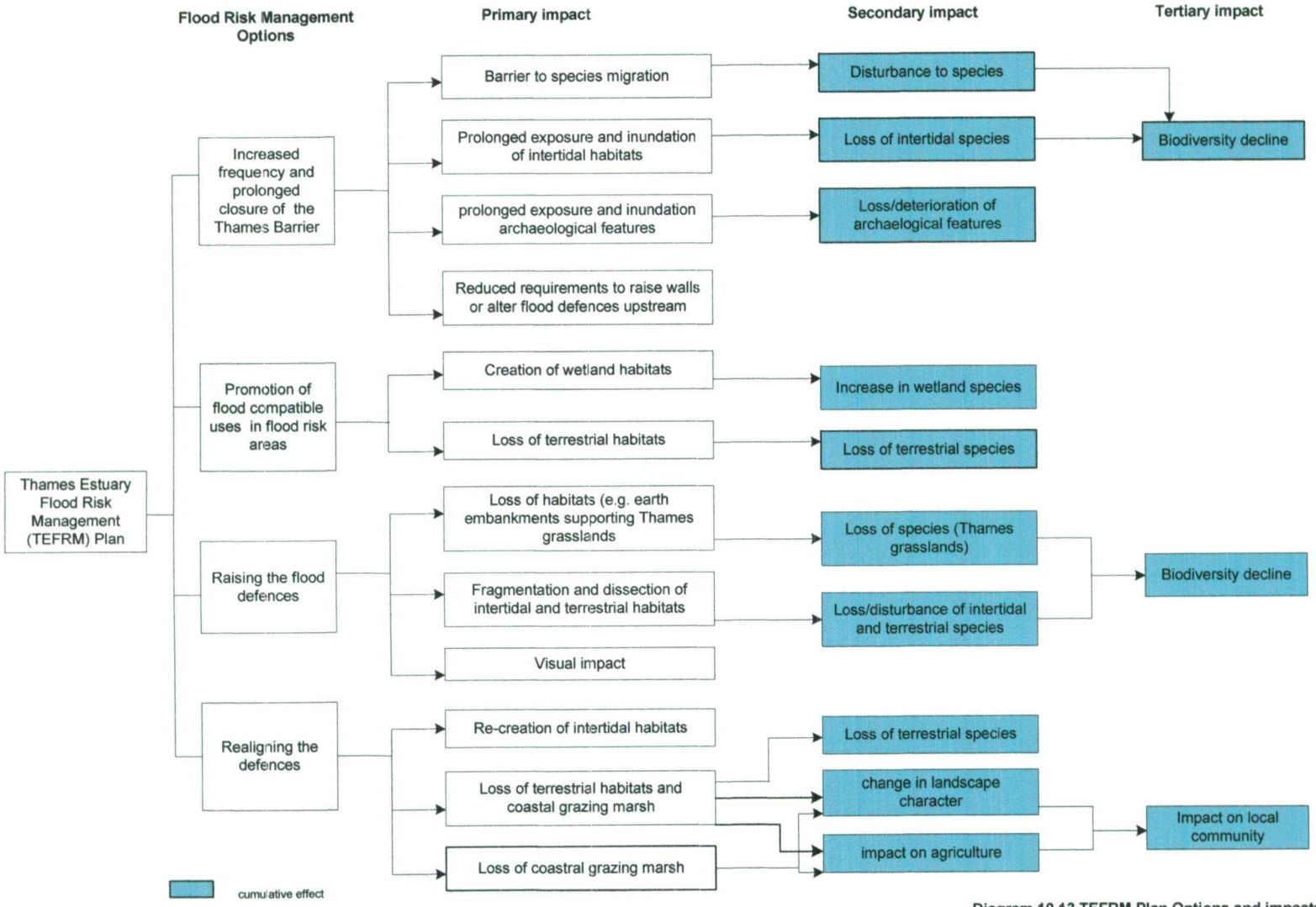


Diagram 10.13 TEFRM Plan Options and impacts

10.10 Summary

This chapter focused on the application of the draft Framework to case studies in terms of approach, process and the network analysis method. This informed the revision of the draft Framework, which is discussed in the next chapter.

Chapter 11. Evaluating the Framework

11.1 Introduction

The evaluation of the contents of the draft framework consisted of two elements. Firstly, the requirements of the Framework were applied to sub-case studies to analyse how the Framework could have assisted or improved consideration of cumulative effects in those cases. Documentary analysis and interviews were carried out and the results are discussed in section 11.3. Secondly, in order to evaluate its contents, copies of the draft framework in the form of guidance and a short questionnaire were sent to 33 respondents. The draft guidance was then revised, taking into account the responses to the questionnaire and the findings from its application to the case studies. The changes made to the draft framework are discussed in the final section of this chapter. These elements of the research were expected to answer the final research sub-question: *Could a framework that integrated CEA into the strategic environmental assessment of plans be developed which could assist planners and practitioners in considering cumulative effects more effectively?*

11.2 Findings from the evaluation questionnaire

A copy of the draft guidance and a questionnaire was sent to 33 respondents consisting of planners, SEA practitioners and experts. These included 13 respondents who were previously interviewed and were chosen because of their involvement in the strategic planning process. However, the number of respondents was increased to include those involved in the implementation of the SEA Directive. The short questionnaire asked for comments on the content and structure of the draft guidance. A copy of the questionnaire is included in Appendix 7. Around one third of the respondents (33%) replied. Very detailed comments were received from the Environment Agency, an environmental consultant, and the ODPM. From the ODPM, comments were received from the government official from the EIA Branch who is in charge of the implementation of the SEA Directive and from an official in the Planning Inspectorate.

Most of the comments received were quite specific and a summary is set out in Table 11.1. The comments are categorised into the following themes: usefulness of guidance, CEA concept, CEA approach and process, baseline conditions, indicators & thresholds, assessment of effects, mitigation measures, monitoring and management, consultations and guidance structure. Most of the respondents (99%) commented that they found the

draft guidance useful. Indeed, one respondent stated that the CEA will inform the SEA of the County Council's Minerals Local Plan and asked if some of the material could be used. Some respondents commented that particular Tables would be useful to them. The main criticisms revolved around two points: the relationship between CEA and SEA need to be clarified and the use of overseas examples. Overall, the respondents gave helpful suggestions, such as those concerning baseline data and the need to expand the mitigation and monitoring sections.

Table 11.1 Summary of respondents' comments and action taken

Comments	Respondent, organisation	Response/action taken
Usefulness of framework		
This work is greatly welcomed as it brings together and takes forward a subject area that is neglected in EIA & SEA which is extremely important to decision making. This work will greatly influence CEA in Surrey County Council's SEA of the Minerals Local Plan.	Thomas Jones, Surrey County Council (SCC)	-
Useful contribution to the field of SEA of plans. Logical and practical although some aspects are quite technical.	Angela Roughton, Dartford Borough Council	Examined draft Guidance to see whether the technical aspects could be presented in a simpler way.
A comprehensive treatment of a technically challenging subject in a relatively succinct document. Very clear document which when finalised would become a valued reference for SEA practitioners. The technical content was difficult to absorb in one go. Tables 8, 10 and the Quality Assurance checklist are very helpful.	Ian Smith, English Nature	Paid attention to the more technical aspects to see whether these could be made simpler.
A comprehensive and clear description of a process which set out clear guidance on how to apply it.	Terry Robinson, Countryside Agency	-
Document very welcome, well presented and useful.	Alison Brown, Countryside Council for Wales (CCW)	-
Very good generally, helpful and insightful document. Need to update taking into account the final SEA guidance.	Roger Smithson, ODPM Kim Harding, ODPM	The revised Guidance takes into account the recommendations of the SEA Guidance issued on October 2003.
Comprehensive piece of work, a lot of useful material and case studies but needs to be shorter, simpler and more prescriptive with worked examples. Many examples of approaches taken from overseas and for project level EIAs. Their adaptability to the UK context & SEA Directive requirements need to be considered.	Gerard Stewart, Environment Agency (EA)	The Guidance was made shorter by removing some background material and the language made simpler. Examples from overseas taken out and UK case studies were incorporated. Focused on approaches for strategic CEA and the requirements of the SEA Directive.

Comments	Respondent, organisation	Response/action taken
Presents useful overview of CEA issues and how they are tackled overseas but needs further development to adapt it more closely to the UK context. More of a review than guidance.	Jo Treweek, Consultant	More discussion on CEA issues that planners in the UK have to address were incorporated into the final Guidance. References to overseas practice reduced.
A useful reference document. Brings together existing guidance and reviews practice overseas rather than putting forward new guidance which need to be reflected in the title.	Abigail Raymond, Kent County Council (KCC)	The title has been revised and references to overseas practice reduced. The final Guidance was revised by including UK cases and focusing on the requirements of the SEA Directive.
Confused between CEA and SEA. Confused the situation with references to cumulative effects of projects.	John Zetter, UCL (formerly DETR)	The relationship between CEA and SEA is further defined. References to project EIAs reduced.
Cumulative effects concept		
Explains concept clearly but examples are weak. More real practical problems of addressing cumulative effects using UK datasets and information would be useful.	Jo Treweek, Consultant	More examples of problems in addressing cumulative effects in UK cases were incorporated.
Need to explain concept more since that is what is currently needed.	Gerard Stewart, EA	The concept was discussed further, focusing on issues that planners have to deal with at strategic level. Focused on the cumulative impacts of a policy – regeneration policy-provided examples of potential issues from that policy and related proposals.
CEA approach & process		
Need to clarify relationship between CEA & SEA. Emphasise more the incorporation of CEA into SEA rather than a parallel process	John Zetter, UCL	Revised flow diagram to illustrate how CEA can be incorporated into SEA.
Clarify role of CEA in SEA- as a parallel exercise or part of SEA. Emphasise that the CEA steps reflect SEA stages. Clarify the extent to which CEA can be integrated into existing procedures.	Jo Treweek, ITE	Defined role of CEA in SEA. Flow diagram shows the interrelationship between CEA and SEA. Discussed further how CEA can be integrated into planning procedures.
Not very clear how CEA component links with the SEA process and how framework fits in with SEA guidance steps. Not enough guidelines on when particular CEA approaches would be useful (for different types or tiers of plans/programmes). Not enough analysis of strengths / weaknesses of various CEA approaches. Discuss applicability of approaches to UK needs in meeting SEA Directive requirements.	Gerard Stewart, EA	Linkage between CEA and SEA is further defined. Revised Figure 3 to show integration of CEA into SEA process more clearly. Indicated CEA approaches and methods that can be used at strategic level and other planning tiers. Weaknesses and strengths of various CEA approaches as well as applicability in meeting SEA Directives were highlighted in final Guidance.

Comments	Respondent, Organisation	Response/action taken
Provide context for 'appropriate assessment'	Alison Brown, CCW	Proposed process can also be used in 'appropriate assessment' - This is dealt with in Part 1 section 5.6.
No mention of precautionary principle. No mention of integration with SEAs of other sectors Table 7 – no mention of iteration Figure 5 needs more feedback loops to show iteration	Alison Brown, CCW	Incorporated the precautionary principle into the list of guiding principles. CEA framework prepared for development plans but could be modified and applied to SEAs of other sectors as stated in Part 1 section 5.6. Feedback loop showing iteration in Figure 3 (Figure 5 in draft) made more prominent.
Scoping should be conducted before screening or at least concurrent Section on establishing temporal boundaries- very good	Roger Smithson, ODPM	Role of cumulative effects issues in Screening clarified in reference to the requirements of the Directive
Sections on identifying potential cumulative effects (good) & establishing temporal boundaries (very good)	Kim Harding, ODPM	-
Baseline conditions		
Indicate to what extent SEA recording of baseline conditions need to be adapted to take account of cumulative effects	Jo Treweek, Consultant	Addressed this issue in Part 2 section 4.3.
Not appropriate to use ecosystems. Suggest the use of biogeographic zones instead.	Alison Brown, CCW	Taken into account by using landscape units since most plans are prepared using these.
Indicators/thresholds/criteria		
Include how to set robust criteria and targets for judging when critical limits have been breached	Thomas Jones, Surrey County Council	Methods for setting criteria incorporated in the discussion on thresholds in Part 2 section 4.5.
More information on workable thresholds would be useful	Jo Treweek, Consultant	Incorporated more information on thresholds.
Incorporate environmental capacities as well as thresholds and limits	Alison Brown, CWW	Included discussion on environmental capacities
Explain role of indicators in impact prediction. Need more on how to determine significance through the use of thresholds and how it relates to the concept of carrying capacity / limits of acceptable change. Discuss issues faced by decision makers relating to these issues.	Roger Smithson, ODPM	Role of indicators in assessing significance of effects discussed further in Part 2 section 4.5. Thresholds are further discussed in relation to carrying capacity and limits of acceptable change and the usefulness of these concepts to decision-making.
Assessment of effects		
Include more information on how to determine magnitude of impacts e.g. where to go for information. This section is helpful in terms of how to organise the information.	Jo Treweek, Consultant	Further guidelines on how to determine magnitude of impacts – data needed and where to get information were provided.
Mitigation measures		
Not enough on mitigation, such as what kinds of mitigation might be required to deal specifically with cumulative effects?	Jo Treweek, Consultant	Mitigation section expanded. More examples of types of mitigation measures at strategic level.

Comments	Respondent, Organisation	Response/action taken
Monitoring and Management		
Section too vague and short.	Jo Treweek, Consultant	This section has been expanded and more detailed examples provided.
Section on designing and implementing monitoring is good.	Roger Smithson, ODPM, Kim Harding, ODPM	-
Consultations		
Not enough on consultations and what kinds of issues consultees need to be aware of.	Jo Treweek, Consultant	Guidelines on consultations regarding cumulative effects issues incorporated.
Other considerations		
Need to consider other policies and plans which have impact on LPA development plans.	Alison Brown, CCW	This is already dealt with in Part 1 section 4.6 but further guidelines are provided.
Identify any gaps/ weaknesses in other guidance.	Abigail Raymond, KCC	This is incorporated into the Introduction.
Consider limitations on data availability & resources	Angela Roughton, Dartford Borough Council/ Abigail Raymond, KCC	This issue is addressed in Part 2 section 5.1.
Examples/approaches relating to project level- transferability needs to be considered	Gerard Stewart, EA	Project EIA examples and approaches removed and examples mostly taken from strategic level.
Guidance structure		
Well structured. Might be useful to produce two documents: succinct guide to CEA and longer background on CEA.	Gerard Stewart, EA	Reduced discussion on background and CEA Guidelines made shorter.
Background should be separated from the guidance itself.	John Zetter, UCL	Background information reduced and placed in Part 1.
Needs to be clearer about objectives and conclusions.	Abigail Raymond, KCC	Objectives re-examined and re-stated and made document more focused.

The comments and suggestions listed above were taken into account in revising the framework and guidance. Together with the findings from the application of the framework, which tested the process and network analysis method, changes were made to the framework and these are listed in section 11.5.

11.3. Findings from application of the framework to case studies

The application of the draft framework to case studies were carried out primarily to test the proposed approach, process and method. As discussed in Chapter 10, the process for considering cumulative effects in the planning processes of each case study were analysed using criteria derived from the draft framework. Although each case study had some form of approach to offer in addressing cumulative effects, it did not have the strategic, holistic and systematic attributes that the framework had. The findings from the application of the framework to case studies are shown in Tables 11.2, 11.3, 11.4 and 11.5. It should be noted that although the CEA framework was designed to

incorporate CEA into SEA, there were no equivalent existing cases that could have been used. So actual planning cases were compared to the proposed Framework. The purpose was to examine how cumulative effects could have been addressed more effectively in the case studies if the CEA framework had been used. The first theme for the analysis related to guiding principles.

Table 11.2 Guiding principles suggested in the draft framework and their application to the case studies

Guiding Principles	Millennium Quarter	Creekside	Ebbsfleet	TEFRM
Addressing cumulative effects should be an objective of the strategic planning and assessment process	✓	◖	✓	◖
Areawide or regional perspective	◖	◖	✓	✓
Consideration of cumulative effects integrated into the strategic planning and assessment process				
Systems approach	×	×	×	✓
Extended temporal scope	◖	?	✓	✓
Extended geographical scope	◖	◖	✓	✓
Focus assessment on cumulative effects on valued resources	✓	◖	◖	◖
Consider other actions and their effect on valued resources	✓	✓	✓	✓
Consider range of impacts	✓	◖	✓	?
Mitigation measures for cumulative impacts	✓	◖	◖	?
Monitoring of cumulative impacts	×	◖	◖	×
Multi-stakeholder involvement	◖	✓	✓	✓
Precautionary principle	✓	?	✓	✓
Iterative process	×	×	?	?

Key: ✓ - guiding principle applied; × - guiding principle not applied; ◖ - guiding principle partially applied; ? - not apparent

Table 11.2 shows that not all the guiding principles were applied in the case studies. The assessments of effects were conducted only partially on an area-wide basis in two of the cases and the temporal scope was limited in these two cases. The systems approach was mentioned in one case although multi-stakeholder involvement was adopted in the four cases but with varying levels of involvement. All of the cases considered other actions and their effect on selected resources but only for certain impacts such as transport and ecology.

Table 11.3 Elements of the draft CEA framework process addressed in case studies

CEA Process	Millennium Quarter	Creekside	Ebbsfleet	TEFRM Plan
Scoping - identify potential cumulative impacts - identify valued resources	Identified types of cumulative impacts and receptors Important cumulative impacts: transport and noise	Identified cumulative impacts on transport and ecology Valued resources identified – habitats and species and affected local community	Identified cumulative impacts on transport, ecology and archaeological resources Valued ecological and archaeological resources identified as well as affected local community	Valued natural and heritage resources identified. The need for a cumulative environmental appraisal of options identified.
Baseline conditions	Traffic surveys and noise monitoring	Ecological survey and traffic survey	Detailed surveys- ecological, traffic	Detailed surveys – habitats
Impact prediction and assessment	Transport modelling	Transport modelling and public transport accessibility rating	Transport modelling and capacity studies	Hydrological modelling
Mitigation	Policy promoting use of public transport; Increase capacity of DLR; Code of construction practice and planning conditions to mitigate noise impacts	Policies promoting use of public transport and limiting parking to discourage car use. Planning conditions: Habitat creation to compensate habitat loss.	Policies: Promoting use of public transport. Provision of Green Grid for cycling and walking Conservation of area around Ebbsfleet River	Proposed changes in legislation and regulations
Monitoring	Noise monitoring	Monitoring of new habitats (brown roofs)	Monitoring of air quality	
Management	Planning conditions	Planning conditions	Planning condition: management of open spaces	Considered management options
Consultations	scoping	scoping	scoping	scoping

Table 11.3 compares the process proposed in the draft CEA framework with the planning and assessment processes in the case studies. Indicated are areas where case study practice conformed to the proposed process in the draft framework. For example, all the cases identified valued resources or receptors and in some cases, undertook baseline surveys for particular concerns. However, consideration of other plans or actions that might affect resources was mostly limited to the immediate area and to existing and future developments. Past developments were not often considered. Secondary impacts and interrelationships of impacts were considered to some extent in the Millennium Quarter. Although potential cumulative impacts were identified during the planning of two cases (Millennium Quarter and Ebbsfleet), the assessment actually

occurred during the development control process and so mitigation measures were limited to planning conditions.

To analyse the effectiveness of the approaches adopted in the case studies, approaches were compared to the proposed approach in the Framework (i.e., integrating CEA into SEA and strategic planning). Table 11.4 shows the findings.

Table 11.4 Analysing the effectiveness of the approaches used in the case studies

Criteria	Millennium Quarter	Creekside	Ebbsfleet	TEFRM Plan
Integration into the plan-making process	◖	◖	✓	✓
Commitment	✓	✓	✓	✓
Multiple organisation involvement	◖	✓	✓	✓
Led to better understanding of cumulative effects	◖	◖	◖	?
Input to strategic planning	◖	✖	✖	✓
Contribution to decision-making	◖	◖	✓	?

Key: ✓ element applied; ✖ - element not applied; ◖- element partially applied; ? – not apparent

As shown in Table 11.4, although cumulative effects issues may have been recognised at strategic level (Millennium Quarter, Creekside and Ebbsfleet) the assessment was undertaken during the development control process. Therefore, input to strategic planning was limited or none. Although the TEFRM Plan SEA incorporated cumulative effects considerations, the approach adopted was Cumulative Effects Appraisal and so how effective that would be is uncertain.

The next table, Table 11.5, indicates where the CEA framework could have improved the case study processes in addressing cumulative effects. Improvements to each of the case studies are discussed in detail in Chapter 10. The criteria by which improvements to traditional analyses are judged include: relevance and contribution to decision-making, effectiveness and efficiency. To be relevant, CEA should be integrated with planning and decision-making. Effectiveness consists of the following elements, which are necessary for the effective application of CEA: early initiation; clear, specific objectives; strategic; appropriate scope; systematic process and adequacy of methods. Efficiency means delivering the outcome at least cost and in minimum time.

Table 11.5 Aspects where the use of the CEA framework would have improved case studies

Framework elements	Millennium Quarter	Creekside	Ebbsfleet	TEFRM Plan
Clear objective to consider cumulative effects	√ Potential cumulative effects considered at the start	√ Potential cumulative impacts considered at start	√ Cumulative effects considered more thoroughly at strategic level	√ Cumulative effects to be considered at the start
Early, systematic consideration of overall effects- direct, indirect, cumulative, secondary, tertiary	√ Early consideration of effects- proactive, rather than reactive avoid problems later	√ Overall effects considered early in the process	√ More attention to indirect effects	√ Cumulative effects considered early in the process and approach conform to CEA principles
Consideration of other actions	√ Other devts in the Isle of Dogs would have been included in the analysis	√ All proposed devts in the area would have been considered	√ All proposed devts to consider cumulative effects	√ All actions affecting valued resources considered
Appropriate study area for each cumulative effect issue	√ Wider scope for each cumulative effect	√ help define cumulative effects issue for both authorities	√ Ecological and water issues considered over a wider area	√ Appropriate scope for analysis of cumulative effects
Wider area perspective	√ The assessment set within the context of the Isle of Dogs	√ Coverage of analysis over wider area	√ Coverage of analysis over wider area	√ Coverage of analysis over wider area
Baseline conditions for cumulative impact receptors established	√ Receptors of noise impacts better defined to help decision-making	√ Better definition of cumulative impact receptors	√ Appropriate baseline for receptors established	√ appropriate baseline for cumulative impact receptors established
Criteria for determining cumulative impact significance defined	√ Criteria set by the planning authority rather than developers consultant would have helped decision-making	√ Agreed criteria between the planning authorities would have avoided disagreements later on.	√ Significance criteria for cumulative effects established and adopted by planning authorities	√Criteria based on change in baseline conditions and trends analysis established. More appropriate than sustainability objectives.
Evaluation of residual impacts which could lead to cumulative effects	√ Residual impacts properly considered	√ Residual impacts properly considered	√ Residual impacts properly considered	√ Residual impacts properly considered
Mitigation measures at strategic level	√ Policies to mitigate cumulative noise impacts established at plan stage rather than through planning obligation	√ Policies to mitigate potential ecological impacts established at plan stage	√ Policies to mitigate cumulative impacts on services established at plan stage	√ Mitigation measures for cumulative effects proposed
Monitoring of cumulative impacts	√ monitoring of valued resources established at plan stage would help assess cumulative impacts later on	√ monitoring of effects covering more issues and over the whole study area	√ monitoring of valued resources established at plan stage would help assess cumulative impacts later on	√ monitoring of valued resources established at plan stage would help assess cumulative impacts later on
Minor actions not covered by EIA considered	√ other small devts considered	√ other small devts considered	√ other small devts considered	√ other small devts considered

As seen in Table 11.5, the areas where the CEA framework would have been most useful are:

- Establishing clear objectives regarding cumulative effects considerations;
- A systematic consideration of overall impacts early in the planning process;
- Better consideration of other actions outside the Plan area that may affect the same resources;
- Definition of appropriate study area for each cumulative impact;
- Improved understanding of cumulative impacts and its attributes;
- Criteria for determining significance acceptable to planning authorities concerned;
- Identification of mitigation measures at policy level which would be more useful than planning conditions for addressing cumulative effects;
- Identification of baseline surveys and monitoring requirements for assessing cumulative effects early in the process.
- Cumulative impact considerations at strategic level can help lower level EIA process by defining which issues to investigate;
- Other actions not covered under the EIA regulations but could result in cumulative impacts can be considered.

11.4 Evaluation of the network analysis method

The application of the framework to case studies included evaluating the network analysis method. In Chapter 9, the reasons for choosing this method were discussed, those relating to the nature of the method, such as the ability to identify higher order impacts and impact relationships and those relating to whether planners can readily apply it using available data. As one respondent commented on the questionnaire evaluation, the framework should take into account limitations on data and resources.

In evaluating the network analysis method, the evaluation criteria used were based on criteria for evaluating risk assessment methods developed by Covello et al (1993). Covello et al (1993) identified a set of criteria for evaluating risk assessment methods: logical soundness, completeness, accuracy, acceptability, practicality and effectiveness. The first three criteria (internal criteria) relate to the quality of the analysis and can be evaluated with reference to the discipline in which the methods are based while the last three criteria (external criteria) address the pragmatic considerations that go beyond scientific disciplines and depend on how the method would be used. Since the network

analysis method was used in a different context than those to which risk assessment methods apply, the criteria were modified before application. For example, under the accuracy criteria, confidence levels were not applicable because network analysis is a qualitative method. The list of criteria and findings from applying the network analysis method are set out in Table 11.6.

Table 11.6 Findings from the application of network analysis

Criteria	Findings from application of method
Logical soundness-degree to which method can be justified	Logical in approach by linking cause and effects.
Completeness – ability to account for all problem aspects	Can only account for problems where data is available.
Accuracy – is the method likely to be biased	Although based on data, analysis depends on knowledge of impacts and possible effects.
Acceptability – can non-technical people understand it; is it compatible with existing processes	Planners and lay people can understand the method and it can be used within planning. Case study interviewees responded positively when shown examples.
Practicality - level of expertise required to apply technique; - time required to apply technique; - input data availability; - ability to use different types of data	Potential impacts can be identified from documents and planners are quite knowledgeable about potential impacts in their area. Time required depends on understanding of causes and pathways. Can use different types of data.
Effectiveness - Usefulness of results- do the results support important tasks or decisions? - Range of applicability – is the method applicable to different cumulative effects problems/ - Generalizability – are insights and conclusions generalizable to other areas? - Does the method link effectively with other types of methods?	Network analysis can highlight causes such as policies or proposals that are likely to result in cumulative effects and inform decision-makers. The method can be applied to different types of cumulative impacts. Conclusions cannot be generalizable because cumulative effects depend on the context. The method can be used with other methods. Networks can identify impacts and threshold analysis can be used to assess how significant the impact is likely to be.
Analysis of effects – Did the method allow the identification of primary, secondary, tertiary and higher order effects and impact relationships?	The method was useful in identifying higher order impacts and impact relationships.

Modified from Covello et al, 1993

As the table above indicates and as illustrated in the network diagrams in Chapter 10, the network analysis method has been useful in identifying cumulative effects. It is practical in that a single researcher can apply the method using available data. Its acceptability was tested during the case study interviews where draft network diagrams were shown to planners and environmental officers who responded positively and suggested other uses: as a heuristic tool which can be used in public inquiry to illustrate cumulative effects and a tool to organise information. One interviewee suggested improvements that could be made, such as incorporating mitigation in the diagram. This was later incorporated in the final Creekside network diagram (see Diagram 10.5 in section 10.7.5). One limitation of the method relates to its inability to quantify impacts

although as shown in Diagram 10.4 (section 10.6.6), it is possible to indicate quantifiable potential levels of noise impacts. Furthermore, the level of detail that a network diagram could trace higher order effects depends on the availability of detailed data. These issues will be discussed further in Chapter 13.

11.5 Revisions to the draft framework

Based on the results of the application of the draft framework on the case studies and questionnaire findings, extensive changes were made to the draft framework. The main ones were:

- The draft framework drew on CEA experience abroad, particularly the US and Canada. CEA in the UK is very limited and although there is more experience of SEA, the consideration of cumulative effects is an underdeveloped area. Nevertheless, a few UK examples, such as the Countryside Council for Wales CEA study were highlighted. Furthermore, the findings from the case studies were used to help define cumulative effects issues that planners deal with and provide examples.

- The draft framework had made references to project EIAs in terms of CEA approaches and methods. These references have been removed and the final framework focuses on strategic CEA and considers methods and approaches appropriate to this level.

- The draft framework was based on the draft SEA guidance (ODPM, 2002) which was available when the framework was designed. Since then, the SEA guidance (ODPM, 2003) has been issued and so the final framework takes this into account and highlights the requirements of the SEA Directive.

- The concept of cumulative effects is explained further by providing examples and relating it to policies and proposals. To illustrate cumulative effects from a policy, those relating to regeneration policy are presented.

- The relationship between CEA and SEA is defined in more detail. A diagram showing where and how CEA integrates into the SEA and planning stages is included in the final framework.

- The network analysis method was promoted in the draft framework as a useful tool for identifying impacts and impact relationships that could lead to cumulative effects. Generic network diagrams were supplemented by an actual example from a case study. Furthermore, a table analysing the application of CEA methods in strategic level assessments is included in the final framework.

- Certain aspects, such as thresholds, indicators, monitoring and consultations which were briefly covered in the draft framework are discussed in more detail in the final framework.

- By removing some background information and making it simpler, the final framework is shorter and more in line with other existing guidance.

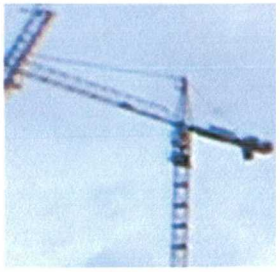
11.6 Summary

The findings from the questionnaire evaluation and the application to case studies informed the revision of the draft framework. Following these revisions, the final framework is set out in Chapter 12.

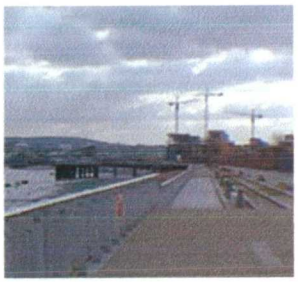
Chapter 12. The Final Framework

12. 1 Introduction

The final framework is included in the rest of this chapter. It is set out in the form of guidance entitled *Guidelines for Cumulative Effects Assessment in SEA of Plans.* It incorporates changes resulting from the case study application and the evaluation questionnaire.









Guidelines for Cumulative Effects Assessment in SEA of Plans

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Introduction

These guidelines provide an approach for undertaking cumulative effects assessment (CEA) at strategic level. CEA can be undertaken as part of regional planning and land use studies but these guidelines have been developed to incorporate CEA into strategic environmental assessment (SEA) of development plans.

The Strategic Environmental Assessment (SEA) Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment, which was adopted on the 27th of June 2001[1], provides an opportunity to address cumulative effects at strategic levels. The SEA Directive requires the consideration of: *'the likely significant effects...including cumulative and synergistic effects on the environment...'* (Annex1)[2].

The SEA Directive applies to a wide range of plans and programmes, including local authority development plans and Regional Planning Guidance and the proposed Local Development Frameworks and Regional Spatial Strategies. The ODPM has issued guidance[3] on the application of the SEA Directive for those plans in England.

These guidelines should complement the ODPM SEA guidance and other planning guidelines by providing a detailed process for considering cumulative effects. The purpose of these guidelines is to assist planners and practitioners to systematically address cumulative impacts at various stages within the SEA process. It could also be useful to decision makers, statutory consultees and other agencies involved in the planning and SEA processes. The guidelines consist of two parts:

- Part I provides the background and context for cumulative effects assessment. This section introduces the concept of cumulative effects and discusses the importance of addressing these impacts at a strategic level. The CEA process at strategic level is presented. Finally, it defines the role of CEA in the SEA process.

- Part II consists of the guidelines. Initially, guiding principles for CEA are outlined. Then it explains how CEA fits within each stage of the SEA and plan preparation processes. Methods for addressing cumulative effects at each stage are discussed in terms of their strengths and weaknesses.

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[1] Commission of European Communities (CEC) (2001). *Directive 2001/42/EC of the European Parliament and the Council of 27 June on the assessment of the effects of certain plans and programmes on the environment.* OJL 197, 21.7.2001 (available to download at http://europa.eu.int/comm/environment/eia/sea-legalcontext.htm#adopt)

[2] CEC (2001), *ibid.*

[3] ODPM (2003) The Strategic Environmental Assessment Directive: Guidance for Planning Authorities. Available at http://www.odpm.gov.uk.

Section I Background

1 What are cumulative effects?

1.1 Many environmental problems, such as loss of open spaces or increase in air pollution result from the cumulative effects of human activities. Other well-known examples of cumulative effects are acid rain, climate change and loss of biodiversity. Cumulative effects are the combined impacts of a single activity or multiple activities. The individual impacts from a single development may not be significant on their own but when combined with other impacts, those effects could become significant.

1.2 Cumulative effects have been defined as "*the net result of environmental impact from a number of projects and activities*"[4].

1.3 With reference to development plans, cumulative effects can occur from the combined impacts of policies and proposals on specific areas or sensitive receptors.

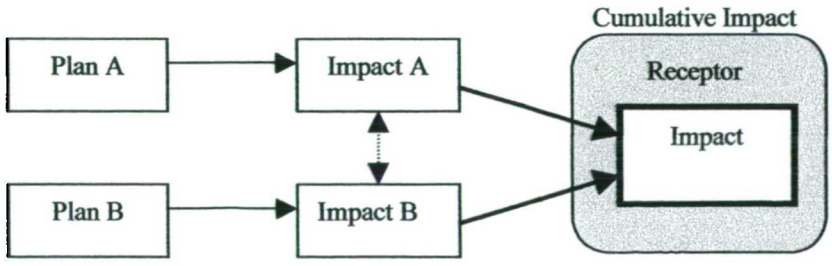
1.4 Cumulative effects can occur from the following situations:

- Combined impacts of a plan with impacts of another plan, affecting the same receptor. For example, proposals from land use and transport plans could interact and affect a nature reserve. This is illustrated in Figure 1.

- Interaction of policies within a plan on the same receptor. For example, a policy to encourage development which promote jobs and a housing policy to provide more housing to meet the borough's target could result in a cumulative loss of open space.

- interaction of impacts from proposals within a plan affecting the same receptor. For example, proposals to build roads, commercial premises and housing in a particular area within a short period of time could result in cumulative impacts (e.g. cumulative noise impacts from construction activities or the combined effect of noise, dust and visual effects) on the residents nearby.

Figure 1. Diagram illustrating the concept of cumulative impacts of plans



[4] Sadler (1996) *Environmental Assessment in a Changing World: Evaluating practice to Improve Performance*. International Study of the Effectiveness of Environmental Assessment Final Report. International Association for Impact Assessment and Canadian Environment Assessment Agency, Canada.

1.5 Cumulative effects occur when there is:

- Spatial crowding or temporal overlap between plans, proposals and actions
- Repeated removal or addition of resources due to proposals and actions
- Repeated alteration of the landscape in the plan area

1.6 Types of cumulative effects are shown in Table 1.

Table 1. A typology of cumulative effects[5]

Type	Main characteristics	Examples
Time crowding	Frequent, repetitive and simultaneous impacts on an environmental resource	Incremental noise from a number of separate developments
Time lag	Long delays between cause and effect	Changes in water table which affects the ecology of wetlands
Space crowding	High spatial density of impacts on an environmental system	Traffic congestion resulting from increase in activities in an area or progressive fragmentation of wildlife habitats from a variety of sources
Cross-boundary movement	Impacts occur some distance away from source	Long range transport of air pollutants
Fragmentation	Change in landscape pattern	Fragmentation of woodlands
Compounding / synergistic effects	Effects resulting from multiple sources or impacts which may be different in nature from the individual impacts	Combination of SOx and NOx to produce smog
Indirect effects	Secondary impacts resulting from a primary activity	Induced commercial and residential development associated with road construction
Triggers and thresholds	Fundamental changes in system behaviour or structure	Deterioration of aquatic systems through chemical contamination from run-off and siltation
Nibbling	Incremental or decreasing effects	Gradual loss of natural areas such as woodlands or greenbelt through discreet developments

1.7 There are many examples of cumulative environmental effects, from the effect of car emissions on the climate, the piecemeal loss of lowland heathland, to the loss of water resources from over abstraction. In the Thames Estuary for example, there has been a 65% reduction in the extent of grazing marshes

[5] modified from Spaling, H (1994). Cumulative Effects Assessment: Concepts and Principles. *Impact Assessment*, 12, pp 231-251.

between 1935 and 1989[6]. Since 1989, these grazing marshes have continued to decline in both extent and value despite nature conservation designation and under increasing threat from surrounding urban areas, climate change and difficulties of traditional management[7].

1.8 Land use planning provides an opportunity to initiate policies, which can result in positive cumulative effects. For example, some urban regeneration strategies have resulted in improved environmental quality for communities such as enhanced visual effects, linked access for pedestrians and public spaces.

1.9 Impact Pathways: These effects can accumulate through additive or interactive processes:[8]

- Incremental effects are those where impacts are repeated additions of the same nature. (a + a + a + a....)
- Interactive or synergistic effects occur when the resulting impact is different in nature to the individual ones. (a + b + c....+ n results in a significant impact).

1.10 Cumulative effects become significant when these impacts on the environment:

- "occur so frequently in time or so densely in space that they cannot be assimilated or
- combine with effects of other activities in a synergistic manner"[9].

There are thresholds where additional disturbance can result in significant deterioration of resources or ecosystems. Cumulative effects become apparent when such thresholds are breached.

2 What is Cumulative Effects Assessment?

2.1 Cumulative effects assessment is a systematic procedure for identifying and evaluating the significance of effects from multiple activities. The analysis of the **causes, pathways** and **consequences** of these impacts is an essential part of the process.

2.2 These three elements define the complex cause-effect relationship that is central to cumulative effects assessment:

- **Identifying sources** – the multiple activities that cause potential impacts or environmental change;
- **Considering processes** – pathways of impacts between the sources and receptors and the linkages among these impacts;
- **Effects** – analysis of the attributes of these effects - whether such impacts are additive, antagonistic or synergistic.

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[6] Nature Conservation Council (1990). *Changes in the Extent of the Thames Estuary Grazing Marshes.* Peterborough.

[7] Environment Agency (2003). *Planning for Flood Risk Management in the Thames Estuary: Strategic Environmental Assessment Inception Report and Scoping.* Environment Agency, London.

[8] Barrow (1997) *Environmental and Social Impact Assessment: An Introduction.* Arnold, London.

[9] Sonntag, H, Everitt,R, Rattie, L, Colnett, D, Wof, C, Truett, J, Dorcey, A and Holling, C (1987). *Cumulative Effects Assessment: A Context for Further Research and Development.* Canadian Environmental Association Research Council, Canada.

CEA at strategic level

2.3 Cumulative effects assessment can be undertaken at different planning levels: project and strategic. Cumulative effects occurring at a regional scale can only be controlled through planning processes directing development at that scale[10]. Effective control of cumulative effects therefore requires regional or area-wide planning and inter-agency cooperation. CEA at strategic level is undertaken to aid planning in addressing these effects. Table 2 summarises some characteristics of strategic CEA.

Table 2. CEA at strategic level

Aspects	CEA at strategic level
Focus	Impacts of plan options, policies & proposals combined with impacts from other plans
Purpose	Improve planning and assist environmental management
Context	SEA and planning process
Strengths	Proactive, early in planning process Can address small actions not covered by EIA regulations Can facilitate project EIA
Limitations	Analysis mainly qualitative Large number of variables Greater uncertainty
Responsibility	Planning authority

2.4 CEA at strategic level addresses the overall effects of policies and proposals of the development plan. Furthermore, it can assess cumulative effects from gradual, piecemeal environmental change caused by a number of individually small projects. It identifies resources that are at risk from cumulative change. Considerations in CEA are listed in Box 1.

Box 1. Considerations for CEA at strategic level[11]

- Assess effects over a larger area than the plan area (regional or across regions);
- Assess effects over a long time period, including the past and future;
- Consider effects on valued resources due to the interaction of the plan and other plans and actions;
- Include other past, present and future plans and actions;
- Evaluate significance in terms of its effect over the wider area;
- Ensure that the plan addresses major concerns relating to the cumulative effects in the plan area, including setting critical thresholds and targets.

[10] Sonntag et al (1987) *ibid.*

[11] Adapted from Hegmann, G, Cocklin, C, Creasey, R, Dupuis, S, Kennedy, A, Kingsley, L, Ross, W, Spaling, H and Stalker, D (1999). *Cumulative Effects Assessment: Practitioners Guide.* Canadian Environmental Assessment Agency, Ottawa. (available at http://www.ceaa.gc.ca/publications-e/cumul/guide-e.htm)

2.5 In terms of specific policies, plans or programmes, cumulative effects can be assessed from several perspectives as shown in Box 2.

Box 2 Perspectives for assessing cumulative effects of policies, plans and programmes[12]

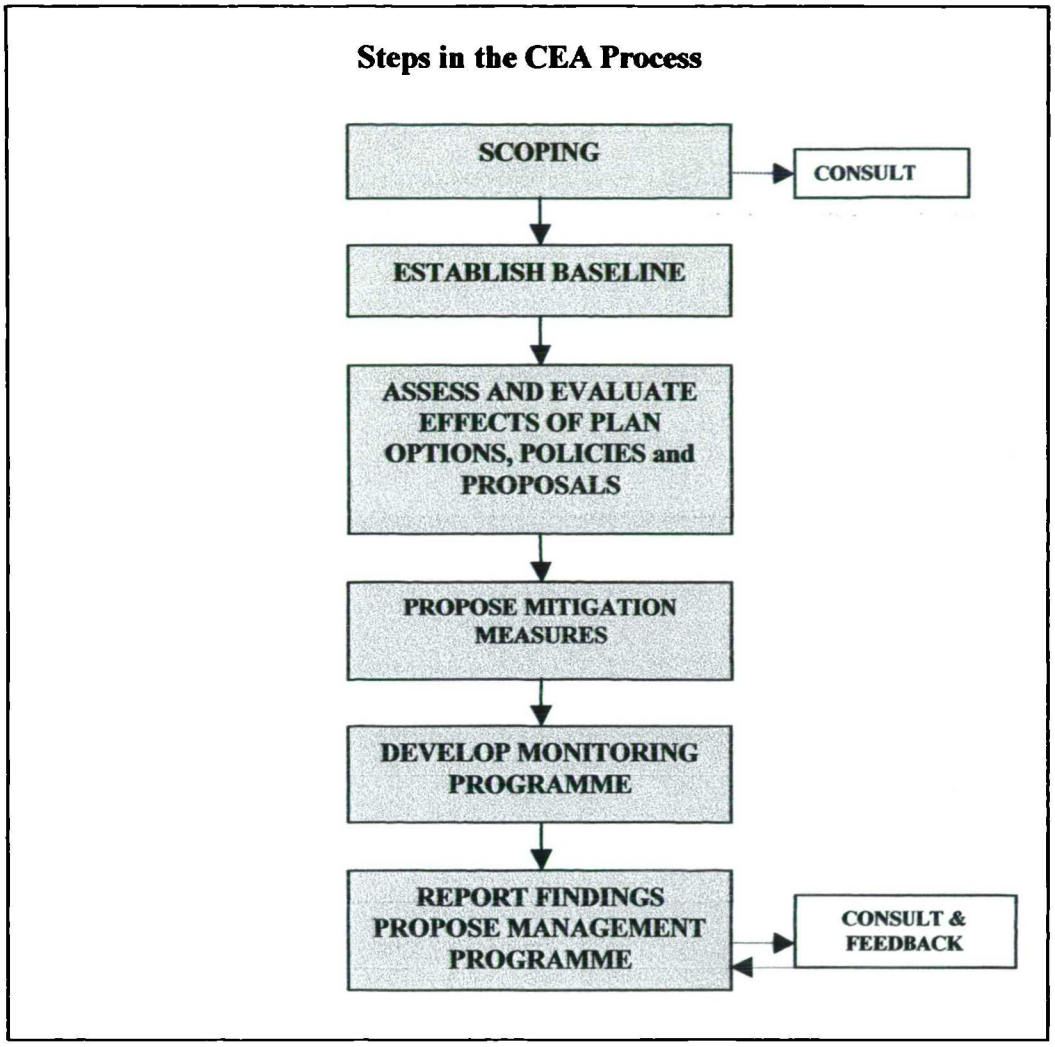
- accumulation of the same impact of a number of projects (e.g. dioxin emissions of a number of waste incinerators in the region;
- accumulation of different impacts from a number of projects:
  - for one type of impact (e.g neighbourhood noise from various sources);
  - for different types of impacts (e.g combined effect on human health from different sources of pollution;
- accumulation over time of the same or different types of impacts (e.g. build up of toxic contaminants and trace elements in ecosystems)
- loss of resources over time (e.g loss of habitats, species, open spaces)

2.6 CEA Process

The main stages for undertaking CEA at strategic level are shown in Figure 2. While specific steps are indicated, the process is iterative and linked. For example, baseline data for the assessment are collected during several phases such as scoping and analysis. When CEA is undertaken as part of SEA, these steps are integrated into the SEA as shown in Figure 4 in Part II, the main part of these Guidelines.

[12] Adapted from Sadler (1996), *op cit.*

Figure 2. The CEA Process at strategic level



3 The importance of addressing cumulative effects in planning

3.1 Cumulative effects should be considered in strategic planning and strategic environmental assessments because these effects can erode environmental quality. These effects are addressed more appropriately at strategic level. In general, these effects are not dealt with effectively in project environmental impact assessments (EIAs) because of limitations in scope. For example, the cumulative effects of landtake by small housing developments can lead to the gradual loss of open spaces and fragmentation of habitats which are not assessed in EIAs. Also, the potential impacts of many individual small-scale developments can become more apparent from strategic perspective.

3.2 The need to consider cumulative effects in planning is recognised in current guidance for SEA and sustainability appraisals. Sustainability appraisal is recognised as a means of helping reconcile economic, social and environmental concerns. Sustainability appraisals have been undertaken regional planning authorities and some local planning authorities.

- The Strategic Environmental Assessment Directive: Guidance for Planning Authorities[13] suggests that in predicting the effects of the plan, cumulative and/or synergistic effects should be considered.

- The DETR Guide for Sustainability Appraisal of Regional Planning Guidance[14] draws attention to the importance of considering cumulative effects in sustainability appraisals. This Guide suggests that the assessment of cumulative effects should follow the appraisal of direct and secondary impacts and identifies two ways of determining cumulative impacts:

  i) assessing the combined impacts of all policies and proposals on specific areas, for example, areas where there are repeated negative impacts; and
  ii) assessing repeated impacts on specific objectives and targets.

- The Town and Country Planning Association's Guide to Sustainability Appraisal suggests that cumulative effects arising from the interaction of policies and proposals should be considered[15].

4 Addressing cumulative effects through Strategic Environmental Assessment

4.1 Cumulative effects are best considered at plan or programme levels, where decisions about future developments are made. Strategic Environmental Assessment is a systematic process of addressing the environmental consequences of proposed policy, plans and programmes[16].

4.2 SEA can facilitate the analysis of cumulative effects since the scope of SEA is appropriate to the temporal and geographical scales at which cumulative effects occur[17]. Policies, plans and programmes can lead to projects and activities with potential impacts. SEA allows an early, overall perspective of the potential impacts and their relationships which could lead to cumulative effects. It also facilitates the analysis of alternatives earlier in the process and so plan options that are less likely to cause significant contributions to cumulative impacts can be selected.

4.3 It should be noted that for SEA to be effective, the assessment of cumulative effects should be an integral part of the process and that CEA should provide inputs at each stage. CEA's role in this process is to focus the analysis on the effects, interactions of these effects and the sensitivities and capacities of the receiving environment. The SEA guidance indicates how SEA can form part of sustainability appraisals. Figure 3 illustrates the relationship between CEA, SEA and sustainability appraisal.

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[13] ODPM (2003), *op cit.*

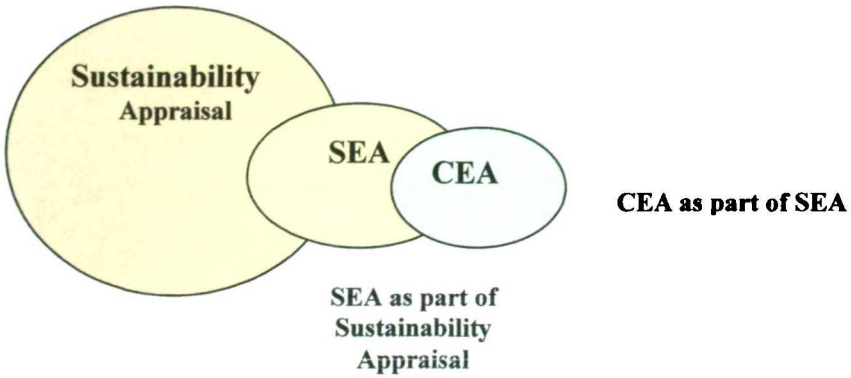
[14] Department of Environment, Transport and the Regions (DETR) (2000) *Good Practice Guide on Sustainability Appraisal of Regional Planning Guidance*. The Stationary Office. London. (available at http: //www.planning.odpm.gov.uk)

[15] Town and Country Planning Association (2002). *Guide to Sustainability Appraisal.* TCPA Tomorrow Series, Paper 12. (available at http://www.tcpa.org.uk).

[16] Therivel, R, Wilson, E, Thompson, S, Heaney, D and Pritchard, D (1992). *Strategic environmental assessment*. Earthscan, London.

[17] Sadler (1996), *op cit.*

Figure 3 Relationship between CEA, SEA and sustainability appraisal



5 Legislative context

5.1 Directive (2001/4/42/EC)[18] refers to cumulative effects in two ways. It requires that cumulative effects should be considered when evaluating the likely significant effects of the plan. It is also a criterion for determining the likely significance of the effects in terms of the characteristics of the effects and of the area likely to be affected.

> The SEA Directive 2001/4/42/EC on the assessment of certain plans and programmes on the environment requires the consideration of: *'the likely significant effects...including cumulative and synergistic effects on the environment...'* (Annex 1) and the criteria for determining the likely significance of effects include the "*cumulative nature of the effects*" (Annex II).

5.2 In the first instance, cumulative effects should be included in evaluating potential impacts and these should be described in the environmental report. Secondly, cumulative effects criteria can be used in screening as to whether a plan or programme would require an SEA.

5.3 The Directive makes two distinctions regarding its application: i) SEA is mandatory for certain plans and programmes and ii) for other plans, SEA is only required where they are likely to have significant effects[19]. For the latter, a screening process is needed to determine whether such plans are likely to have significant environmental effects and in that case, an SEA would be required.

5.4 Annex II of the Directive lists criteria for determining the likely significance of the environmental effects, including the characteristics of the effect and of the area likely to be affected. One of these 'significance criteria'[20] is the cumulative

[18] CEC (2001), *op cit.*
[19] ODPM (2004). *The Draft Environmental Assessment of Plans and Programmes Regulations 2004: A Consultation Document.* (available at http://odpm.gov.uk)
[20] Commission of the European Comunities (2003) *Implementation of Directive 2001/42 on the Assessment of the Effects of Certain Plans and Programmes on the Environment.* Commission of the

nature of the effects and should be taken into account when deciding whether plans for small areas at local level (Article 3 (3)), minor modifications to plans and plans which set the framework for future development consent of projects (Article 3 (4)) would require an SEA.

5.5 To help determine whether significant cumulative effects could result from the implementation of those plans, a series of questions are set out in Box 3 which can trigger an SEA.

Box 3. Cumulative Effects Screening Criteria

Criteria Questions

- Are the potential effects from the plan together with the impacts from other plans likely to be significant?
- Are the potential effects from the plan or proposals within it likely to be cumulative?
- Are there valued environmental resources in the wider plan area likely to be affected by the plan's proposals?
- What is the sensitivity or capacity of these valued environmental resources? What is its state in relation to environmental quality standards or thresholds? Would additional impacts result in limits to be breached?
- How long and frequent are the potential impacts?

5.6 These guidelines on CEA have been prepared in the context of an SEA for land use development plans. It could also be used in SEAs of small areas at local level, plan modifications or plans which set the framework for future development control of projects (Article 3 (3)) which require an SEA. Furthermore, since these guidelines followed the procedure for SEA prescribed by the Directive, it could also be applied to other SEAs of other plans, such as those prepared in the context of the Habitats Directive (Article 6 and 7 of Directive 92/43/EEC)[21].

5.7 These guidelines consist of proposals to assist planning authorities and those preparing the SEA. It is envisaged that those responsible for the SEA should also undertake the CEA component. The next section describes a framework and procedure for assessing cumulative effects in SEA of plans.

European Communities, Brussels. (available at: http://europa.ing/comm/environment/eia/030923_sea_guidance.pdf)

[21] Commission of the European Communities (1992). Directive 92/43/EEC of May 21 1992 *on the conservation of natural habitats and of wild flora and fauna*. OJ L 206, 22.7.1992, p7 as last amended by Directive 97/62/*EC* (OJ L 305, 8.11.1997).

II The Guidelines

1 Introduction

This guidance describes a process for considering cumulative effects in SEA of plans. Although the CEA will follow a procedure in order to identify and assess cumulative effects, it will be integrated into the SEA process. Since the Directive requires that the SEA should be carried out during plan preparation, it is envisaged that the consideration of cumulative effects would also be integrated into that process. Methods that can be used for identifying and assessing cumulative effects are described for each stage of the SEA.

2 Guiding Principles for CEA in SEA of Plans

The main objective of the CEA is to assess potential cumulative effects and their likely significance. To guide the assessment, guiding principles were developed from best practice in CEA identified in the literature and findings from case study research, which investigated actual approaches used by planning authorities to address cumulative effects. The guiding principles are listed in Box 4.

Box 4. Guiding principles

Guiding Principles for CEA in SEA of Plans

- **Goals and objectives**
  CEA should be guided by the goals and objectives of the SEA and the development plan.

- **Area-wide Perspective**
  Adopt a broad, area-wide perspective when considering cumulative effects.

- **Integrated Approach**
  Undertake CEA as part of the strategic environmental assessment (SEA) of plans by integrating cumulative effects considerations at each stage of the SEA and plan-making process.

- **Systems Approach**
  Adopt a systems approach in defining cumulative effects and impact relationships.

- **Adequate scope**
  Establish expanded temporal and spatial boundaries to include all potential sources of effects. Study area boundaries for the assessment should reflect impact and valued resource boundaries.

- **Assessment Focus**
  Focus assessment on potential cumulative effects that would significantly affect sensitive or important environmental resources. Characterise the baseline condition, the stresses affecting these resources and consider trends. Establish thresholds and indicators.

- **Consideration of other actions**
  Consider potential cumulative effects of the plan and other plans and actions that are likely to affect important or valued environmental resources.

- **Impact Assessment**
  Assess direct, indirect, secondary, higher order and cumulative effects of the plan's preferred options, policies and proposals on the important resources. Determine the significance of these effects using criteria based on standards or acceptability.

- **Mitigation measures**
  Propose mitigation measures for cumulative adverse effects and suggest enhancement measures for valued resources. Assess the significance of residual impacts after mitigation.

- **Stakeholder Involvement and partnership approach**
  Apply a partnership approach among parties concerned and involve stakeholders in identifying cumulative effects issues and determining impact significance.

- **Monitoring and Management**
  Monitoring of significant cumulative effects should be undertaken as part of the overall monitoring of impacts of the plan to evaluate the accuracy of impact prediction and help improve future assessments. Feedback from monitoring should be incorporated into the management plan for the area.

- **Iterative Process**
  The process should be iterative and the findings from the CEA should be fed back into the next assessment.

- **Precautionary Principle**
  Due to the uncertainties in assessing and predicting cumulative effects, the precautionary principle should be adopted.

3 Integrating CEA within SEA

3.1 CEA approach

The CEA approach presented in these Guidelines is based on a cause-effect model to establish how multiple stressors are affecting valued resources and the resulting trends evaluated against identified objectives and indicators. The CEA framework presented here was developed through an extensive review of CEA frameworks and guidelines,[22] which were adapted to incorporate the requirements of the EC SEA Directive[23]. EC guidance on the implementation of the Directive[24], the ODPM draft implementing regulations[25] and the ODPM's SEA Guidance were taken into account.

3.2 CEA within the SEA Process

3.2.1 The SEA Directive delineates a number of procedural steps necessary for its implementation and lists the information that should be included in the environmental report, which should include findings on cumulative effects. The SEA Guidance[26] indicates how the assessment can be integrated with sustainability appraisals, which are undertaken by regional and local authorities in the UK. It should be noted that these CEA guidelines are designed within the context of SEA. With regard to sustainability appraisal, the Framework could be applied to that process, providing that it has been modified to incorporate the requirements of the SEA Directive. In particular, sustainability appraisal, which is objectives-led, will require baseline data on valued resources to be able to assess the significance of additional impacts on those resources.

3.2.2 The SEA Guidance identifies the stages of plan-making[27] and SEA. These stages are taken as the starting point for the CEA and the SEA. The purpose of integrating CEA within SEA is to identify and predict the cumulative effects of options, policies and proposals. The framework for incorporating CEA into SEA and its linkages with the Plan-making process is shown in Figure 4. The following sections provide guidelines for each stage of the CEA.

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[22] Useful references include: US Council on Environmental Quality (1997) *Considering Cumulative Effects. CEQ, Washington DC.* (available at: http://ceq.eh.doe.gov.nep/nepanet.htm); Kingsley, L (1997) *A Guide to Environmental Assessments: Assessing Cumulative Effects. Parks Canada.* Department of Canadian Heritage, Hull, Quebec and Hegmann *et al* (1999), *op cit.*

[23] CEC (2001), *op cit.*

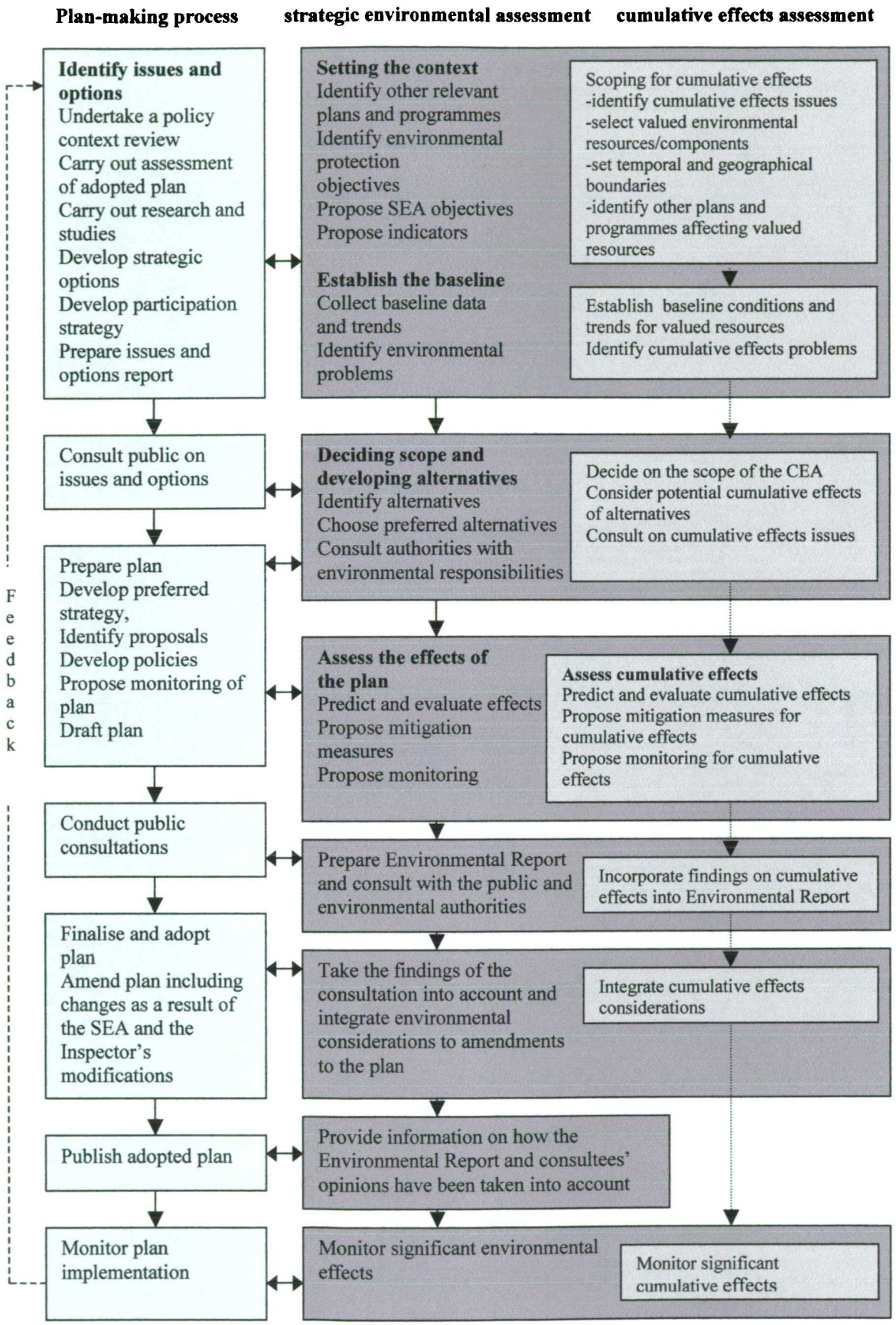
[24] CEC (2003), *op cit.*

[25] ODPM (2004), *op cit.*

[26] ODPM (2003), *op cit.*

[27] Based on ODPM (2002) *Making Plans: a practical guide.* HMSO, London.

Figure 4. Integrating CEA within SEA and linkages with the Plan-making Process[28]



[28] Source: adapted from Cooper, LM and Sheate, WR (2004). Integrating cumulative effects assessment into UK strategic planning: implications of the EU SEA Directive. *Impact Assessment and Project Appraisal*. 22 (1): 5-16.

4. Scoping

4.1 Introduction

4.1.1 Scoping is the process of identifying, from a wide range of problems, a number of priority issues to be addressed. Scoping of key issues relating to cumulative effects is undertaken during Stages A and B of the SEA. In order to be able to assess cumulative impacts later on, there are some tasks that should be undertaken at this stage. These tasks are:

- Identify cumulative effects issues;
- Select sensitive or important elements of the receiving environment[29]/ valued environmental resources where cumulative effects may be a problem;
- Delineate temporal and geographical boundaries for these elements and cumulative effects issues;
- Propose assessment objectives and indicators for cumulative effects;
- Identify other plans and programmes that may affect those valued resources

Each of these tasks will be discussed in the following sections.

4.2 Scoping cumulative effects issues

4.2.1 This involves identifying cumulative effects problems and the valued resources being affected in the area. The SEA guidance indicates that baseline data, including likely future trends is undertaken at this stage. Cumulative effects issues can be identified from the information on major resources and trends. Some examples of cumulative effects issues are listed in Box 5.

Box 5. Examples of cumulative effects issues

- Increase in air pollution resulting in degradation of regional air quality
- Increase in traffic congestion affecting urban environmental quality
- Changes in ecological integrity of protected areas
- Changes in quality of water bodies from increased surface water run-off
- Reduction or contamination of ground water supplies
- Loss of habitats through residential, commercial and industrial development
- Loss of historic heritage through developments
- Loss of open countryside or green spaces
- Changes in hydrological regimes of water courses
- Habitat fragmentation from infrastructure construction or changes in land use
- Habitat degradation
- Loss of biological diversity
- Loss of amenity

[29] The SEA Directive refers to important elements of the receiving environment to include people, resources species and habitats. In CEA these are referred to as valued environmental resources to emphasise that the CEA focuses on selected resources which are at risk from cumulative effects.

4.2.2 Questions to guide the baseline collection relating to cumulative effects issues are set out in Box 6.

Box 6. Identifying potential cumulative effects issues

1. Are there any sensitive or valued resources in the area? What is the state of these resources (trends, thresholds)?
2. Are these resources likely to be affected by the plan?
3. What activities have impacted these resources in the past?
4. Are there any other plans or programmes which might affect the same resource?
5. Which government policies, regulations and standards are relevant to this issue?
6. Are there cumulative effects issues in the area?
7. Have there been any studies on these issues (e.g. erosion of salt marshes)?

4.2.3 Another source of information for cumulative effects issues are the authorities with environmental responsibilities in the area who are to be consulted on the scope of the SEA.

4.2.4 Examples of cumulative effects issues and likely causes are listed in Table 3. These were identified from consultations with regional and local authority planners and officers from government agencies and environmental NGOs.

Table 3. Cumulative effects issues in the Thames Gateway[30]

Cumulative Effects issues	Causes
Increase in traffic and congestion	increase in transport movement and commuting
Increase in air pollution	greater use of private vehicles, industrial releases of nitrogen oxides
Increase in flood risk	new developments (housing) on or close to the floodplain increase in water run-off from built up areas sea level rise and climate change farming practices
Reduction in water supplies and groundwater contamination	many new developments (commercial and housing) in the area
Habitat loss and fragmentation	use of land for development and transport infrastructure
Loss of open spaces and disruption to network of green spaces	development on open spaces and brownfield sites
Loss of inter-tidal area; erosion of salt marshes	sea level rise, encroachment
Increase in waste production	increase in industrial, commercial and residential activities
Impact on water quality of estuary and rivers and on freshwater and marine habitats	increased activity on riverside
Increased demand for utilities (electricity), and services (schools, health and recreational facilities)	growth in population
Impact on urban environment and health (increase in noise)	traffic, construction activities, noise, air pollution
Positive impacts on environmental quality- improved public spaces, public transport, visual quality	urban regeneration programmes: redevelopment of derelict sites, improvement in design standards, provision of public transport, pedestrian & cycle lanes

[30] Cooper, LM and WR Sheate (2004) *op cit.*

4.2.5 Various methods can be used to determine which issues are important. One way would be to construct an interaction matrix listing plan activities against resources. Another method is to use a checklist of questions for each environmental element that could be affected by the plan. A useful method is network analysis indicating which impacts interact and lead to higher order ones. In the Cumulative Impact Study for the Millenium Quarter Developments in Tower Hamlets for example, a matrix was used to indicate potential cumulative impact issues from five development proposals. This is shown in Table 4.

Table 4. Types of cumulative impacts[31]

Type of impact	Issue
Additive	Archaeology and Cultural Heritage Ecology Shadow Soil Conditions and Contamination
Synergistic	Traffic and Transport Air Quality Noise (Construction and Traffic) Water Resources Television and Radio Reception
Neutralising	Townscape and Views Wind

4.3. Selecting valued resources

4.3.1 The focus of CEA is on valued resources which are likely to be affected by the plan. Valued resources are those considered important by the public for environmental, social, scientific or aesthetic reasons. These could be environmental resources such as air quality, water resources, habitats or community resources, such as urban parks and heritage districts. Valued resources also include people. For example, these could be residents in the borough who will be affected by noise and air pollution from proposals to redevelop an area. Valued resources can be identified through the baseline study and consultations with statutory consultees, environmental organisations and the public. In order that key resources are identified, proactive and deliberative forms of public participation may be appropriate or necessary.

4.3.2 It would not be practical or realistic to apply CEA to all resources. The key therefore is to prioritise the environmental resources of concern. Some will be apparent, such as designated protected areas while others will need further consideration and consultations with local organisations or environmental authorities. International and national legislation could also provide a basis for determining priorities.

4.3.3 It is essential that the status of these resources and historical context are established. In this, trends analysis can help understand the existing condition of the resources and the factors that have affected them. Trend analysis will therefore highlight those resources, which are at risk from cumulative change.

[31] Environ (2001). *Cumulative Impact Study: Millenium Quarter Developments*. Environ, London.

4.4 Delineating Temporal and Spatial Boundaries

4.4.1 After identifying the issues and valued resources, temporal and spatial boundaries of the assessment can be established. These are based on the types of cumulative effects to be addressed or the resources. There may be a need for different boundaries for different effects or resources.

4.4.2 Delineating appropriate geographical boundaries in a CEA may be based on relevant landscape units, watersheds or ecological boundaries of the valued resource. The end of the boundary will be the point where the effect becomes insignificant. For development plans, a regional study area may be established to include possible interactions with other plans and programmes.

4.4.3 Examples of possible geographical areas for analysis based on resources are listed in Table 5.

Table 5. Geographical areas for assessing cumulative effects[32]

Resource	Possible geographical areas for analysis
Air quality	Metropolitan or regional area, airshed
Water quality	Estuary, river basin, aquifer, watershed
Vegetation	Woodland, forest or landscape units
Wildlife	Species habitat including breeding and feeding areas
Historic heritage	Historic district or area
Marshland/wetland	Wetland area
Coastal zone	Coastal area
Waterfront	Land and intertidal areas
Recreational areas	Area surrounding a river, lake or park area

4.4.4 Examples of actual cases of geographical and temporal boundaries set relating to cumulative effects are shown in Table 6.

Table 6. Examples of geographical and temporal boundaries

Case	Cumulative effect	Geographical boundary	Temporal boundary
Millennium Quarter Cumulative Impact Study	Noise	Area surrounding five developments	Construction period
	Transport	Study area	Construction until operation
Creekside/West Greenwich Development and Environment Plan	Habitats and species loss and disturbance	Area alongside Deptford Creek	Implementation of Plan covering construction of developments until operation
	Transport	Whole of Creekside	
Ebbsfleet Development and Environment Framework	Ecological effects – loss of habitats	Area around Ebbsfleet river	Implementation of plan
	Transport	Ebbsfleet valley and Kent thames-side	
Thames Estuary Flood Risk Management Plan	Flooding effects	Estuary and watershed	Implementation of Plan

[32] US CEQ (1997). *op cit.*

4.4.5 In a study to assess the cumulative effects of marine activities in Liverpool Bay commissioned by the Countryside Council for Wales, the spatial boundaries were set taking into account the following considerations: natural processes, past, current and future activities; the study area must be large enough to allow ecological requirements of the selected valuable ecological components to be investigated and project budget[33]. The spatial limits established were:

- Western limit – Great Ormes Head
- Northern limit – Ribble Estuary
- Inshore limit – mean low water mark

4.4.6 Temporal boundaries establish how far back the assessment should consider baseline data and trends and how far into the future should impacts be considered. Historical records, such as monitoring data can be used to establish incremental changes over time. For nature conservation areas, for example, the past boundary could go as far back as the point in time when the area was designated. At a pragmatic level, the temporal boundaries could be dictated by the historical data available. The purpose of setting past boundaries is to identify other actions that have affected the valued resource.

4.4.7 In terms of the future boundary, it is important that future policies or management strategies for the affected resource are identified as well as any planned activities that might impact on that resource. Future actions may include:

- proposals, plans or programmes that have been approved or pending approval by the planning authority.
- Plans and proposals by other agencies likely to affect the resources

4.4.8 Some suggestions for establishing temporal boundaries are set out in Box 7.

Box 7. Establishing temporal boundaries[34]

Establishing past boundary:
- When effects similar to those of concern first occurred
- The time at which certain land use designation was made (for example, establishment of a nature reserve, park or planning area)
- At a time previous to any developments in the area

Establishing future boundary:
- End of plan implementation or until the next plan review
- Time when the valued resource has been restored to pre-disturbance conditions
- When the resource is expected to meet environmental quality standards (water quality, air quality)

[33] Oakwood Environmental Ltd (2002) *Development of a methodology for the assessment of cumulative effects of marine activities*. Prepared for the Countryside Council for Wales: Bangor.
[34] modified from Hegmann et al (1999). *op cit.*

4.5 Identifying objectives, thresholds and indicators

4.5.1 After identifying the affected resources and establishing the boundaries, the next step would be to identify the CEA objectives. These objectives should relate to the valued resources selected earlier but take into account the plan and SEA objectives. For example if an SEA objective is to '*ensure the sustainable management of key wildlife sites and the ecological processes on which they depend*' then a CEA objective would be '*reduce further cumulative impacts on key wildlife sites*'. Another CEA objective might be to highlight impacts identified in the SEA that are likely to be cumulative.

4.5.2 Thresholds are limits beyond which cumulative change becomes an important concern, such as loss or degradation of habitat leading to decline of bird population or when air pollution levels result in health problems. Thresholds may be defined in terms of goals or targets, standards and guidelines, carrying capacity or limits of acceptable change. In CEA, environmental thresholds relate to the point where cumulative impacts on the valued resource result in significant effects. Establishing thresholds depend on the resource under consideration. It can be based on standards established by regulations or contained in guidelines (for example, noise, air and water quality standards used in the UK) or value judgements based on scientific, legal and political considerations. For example, biodiversity thresholds have been identified in Local Biodiversity Plans. The objective of establishing thresholds in CEA is to determine whether further impacts on the resource could become significant and identify measures to avoid further damage.

4.5.3 Carrying capacity is the maximum level of use or activity that a system can sustain without undesirable consequences. One example is the visitor capacity in a park, beyond which the area gets too crowded. Limits of acceptable change refer to the change in environmental components that society is prepared to accept. After defining what acceptable conditions are, then levels of use can be determined, a benchmark against which the effects can be assessed.

4.5.4 CEA indicators can measure the achievement of objectives. For example, for the CEA objective to '*ensure that there would be no further cumulative impacts on key wildlife sites*' possible indicators are: no habitat loss from future activities or reduction of disturbance to wildlife sites from future developments.

4.5.5 Environmental indicators in CEA can be useful in describing baseline conditions and establishing trends. Alterations of indicators can be used to predict cumulative effects. Criteria for selecting indicators for CEA[35] include the following:

- Availability of secondary data sources;
- Provision of information on selected valued resources;
- Compatibility with indicators used in monitoring programmes in the area
- Usefulness in measuring cumulative effects which are significant and irreversible or those causing higher order effects;

[35] Stevenson W (1994). *Cumulative effects assessment in EA: an indicators approach.* Presented to the Ontario Society for Environmental Management. 31 May 1994. Ottawa, Canada cited in Hegmann et al (1999).

- Sensitivity to the magnitude, direction and duration of stress;
- Usefulness for predicting thresholds, measuring assimilative capacities and monitoring change

4.6 Identifying relevant plans and programmes that may affect the same valued resources

4.6.1 The SEA Directive requires that the environment report should provide information on the plan's *'relationship with other relevant plans and programmes'* Annex 1, SEA Directive.

4.6.2 In assessing cumulative impacts, the relevant plans and programmes, are those that are likely to affect the selected valued resources. For a local plan, a relevant plan would be the regional plan. These set out future developments in the wider area, which could have impacts on the valued resource. Other plans that would be relevant are, for example, an urban regeneration plan and transport plan of a neighbouring authority, which, together with the plan proposal for housing development could have a cumulative impact on transport.

4.6.3 Criteria for determining relevant plans or programmes:

- Geographical proximity
- Affects the same resource
- Common impact causing activities that could lead to cumulative effects.

4.7 Conducting consultations

4.7.1 The SEA Directive requires that EU Member States designate authorities with environmental responsibilities to be consulted in the SEA process since they are likely to be concerned with the environmental impacts of the plan.

> These authorities should:
> *'be consulted when deciding on the scope and level of detail of the information which must be included in the environmental report* (Article 5(4)) and
>
> *'be given an early opportunity within appropriate time frames to express their opinion on the draft plan or programme and the accompanying environmental report'* (Article 6 (2)). SEA Directive

4.7.2 The SEA guidance suggests that the following agencies should be consulted: Environment Agency, Countryside Agency, English Nature and English Heritage. In some cases it may be appropriate to institute more inclusive and deliberative participation processes, e.g. with regard to transport impacts in urban regeneration plans[36].

[36] Petts, J (1999). Public Participation and Environmental Impact Assessment. In Petts, J. (ed) Handbook of Environmental Impact Assessment. Vol. 1. *Environmental Impact Assessment; Process, Methods and Potential*. Oxford: Blackwell Science.

4.7.3 Since CEA requires that past activities that have affected the resource be investigated, wider consultations with other agencies early in the process would be useful. Input from local organisations could be valuable in defining past activities relating to valued resources in the area. In this case, local environmental NGOs and public interest groups should be consulted. For example, in preparing the sustainability appraisal[37] of the Kent and Structure Plan, workshops to identify key sustainability issues involved internal and external stakeholders.

4.7.4 Some issues that consultees need to be aware of which could assist the CEA are listed in Box 8.

Box 8 Consultation issues relating to valued resources

Valued environmental resources in the area that might be affected by the plan and information relating to these resources:

- Attributes, status, historical background and trends;
- Geographical and temporal dimensions;
- Quality and extent of baseline data;
- Any researches, surveys and monitoring data;
- Stressors (past, and existing) and effects;
- Factors determining their present condition;
- Pressures that the resource is vulnerable to;
- Potential impacts from plan policies and proposals and other plans;
- Parameters best used to measure effects;
- Objectives, thresholds and standards;
- State of management system;
- Legal, policy, political and social considerations;
- Stakeholder concerns;
- Gaps in data.

4.8 CEA Methods for Scoping

4.8.1 There are various methods or techniques for identifying cumulative effects that could be used in CEA and SEA. For scoping, the methods that could be useful are:

- Questionnaires, interviews and panels (for identifying issues, valued resources)
- Checklists (for identifying issues and potential effects)
- Matrices (for identifying issues by setting activities against resources)
- Networks and systems diagrams (for identifying potential direct and indirect effects and impact relationships).

4.8.2 The network analysis method can be used to identify primary, secondary and higher order effects and impact relationships that could lead to cumulative effects. Simple networks are particularly suitable for scoping. An introduction to the method is presented in Section 7.

[37] Kent County Council and Medway Council (2003) *Sustainability Appraisal.* Working Paper 15. Kent County Council, Maidstone.

5 Establish Baseline Conditions

5.1 Baseline information requirements

5.1.1 The SEA Directive requires that the baseline conditions of the environment should be established. The information to be provided includes the environmental characteristics of the areas likely to be significantly affected by the plan. The baseline should include detailed information on the selected valued resources.

> The environmental report should include information on:
> - "the relevant aspects of the current state of the environment and the likely evolution thereof without implementation of the plan or programme"
> - "the environmental characteristics of the areas likely to be significantly affected"
> - "any existing environmental problems which are relevant to the plan or programme including, in particular, those relating to any areas of particular environmental importance, such as areas designated pursuant to Directive 79/409/EEC and 92/43/EEC.
>
> (Annex 1, SEA Directive)

5.2 Establishing the baseline for valued resources

5.2.1 The SEA Guidance suggests that baseline data should be collected during Stage A and clarified during Stage B. The baseline data recording for the SEA would need to be adapted to take account of cumulative effects. Data on selected valued resources will include past factors that have affected the resource, existing pressures on the resource and future pressures on them. Furthermore, data will be required in order to carry out trends analysis. Establishing the baseline condition for CEA should include:

- Characterising the current status of valued resources identified in scoping, particularly their state in relation to thresholds and capacity;
- Characterising the stresses affecting these resources including stresses from past activities;
- Establishing the regional or wider context for these resources by identifying future relevant developments, government regulations and standards and how they are likely to affect the resource;
- Defining the baseline condition for the resource based on trends analysis.

5.2.2 Data on the status of resources can be found in state of the environment reports, biodiversity action plans, conservation plans and research studies. For example, air quality monitoring data can establish pollution levels. Similarly, noise monitoring data can establish current state and these can be related to thresholds.

In the Millennium Quarter Plan Transport Study[38], for example, the capacity of the transport infrastructure (DLR, Jubilee Line and buses) was established in order to assess the cumulative impact of developments on the transport infrastructure. In the Creekside area, survey data on ecological and archaeological resource and historical data on impacts of past developments established a baseline from which cumulative effects could be assessed.

5.2.3 It should be possible to identify the pressures each valued resource is subject to from the state of environment report. Data that characterise important stress factors that are likely to affect the environment should include the types, distribution and intensity of key activities within the area or region and individual indicators of stress on specific resources. Regulatory, administrative and planning information can help define the development pressures within a region.

5.2.4 Trends data would be useful in order to:

- Establish the baseline for the affected environment more accurately (incorporating variations over time and the likely change in the absence of the proposed plan or action).

- Evaluate the significance of effects relative to historical degradation (how close the resource is to threshold of degradation).

For example, in establishing the baseline for the Thames Estuary Management Plan SEA[39], trends relating to ecological resources were identified based on historical data sources (e.g. grazing marsh and saltmarsh).

5.3 Data Sources

5.3.1 Most of the information needed to describe the affected environment can be obtained from regional, local and national centres. Possible sources of information include the local planning authority, proposed regional observatories, research institutions, government agencies, private organisations, environmental NGOs and other consultees. The planning authority holds data on past and future developments, which can be used to determine other activities affecting the valued resource. The Environment Agency, English Nature and RSPB and other bodies hold monitoring data that could be used in trends analysis. This is an area where co-operation among public and private organisations would be helpful.

[38] Arup Transport Planning (2001). *Millennium Quarter Master Plan: Transport Model Update and Forecasting Study Report.* Ove Arup & Partners International Ltd. London

[39] Environment Agency (2003) *Planning for Flood Risk Management in the Thames Estuary: Strategic Environmental Assessment Draft Inception Report.* Environment Agency, London

6 Identifying potential cumulative effects of alternatives

6.1 The SEA Directive requires consideration of alternatives and the reasons for selecting alternatives.

> The environmental report should is required to consider '*reasonable alternatives taking into account the objectives and the geographical scope of the plan or programme*' (Article 5.1).
>
> The environmental report should provide '*an outline of the reasons for selecting the alternatives dealt with*'
>
> SEA Directive (Annex 1h)

6.2 Stage B of the SEA Guidance includes developing alternatives. The SEA guidance proposed that the alternatives considered at this stage would be strategic. More detailed alternatives relating to policies and proposals can be considered in their formulation. CEA needs to take place at the beginning of the plan-making and SEA processes so that different options can be weighed against each other and the policies and proposals of least cumulative impact can be chosen.

6.3 The role of CEA here is to appraise the overall potential cumulative effects of the various alternatives or options on valued resources. One advantage of using CEA at this stage of the SEA is that direct, indirect impacts and impact relationships can be considered. Furthermore, CEA also brings into decision-making the consideration of other plans or activities. Some cumulative effects considerations when comparing options are set out in Box 9.

Box 9. Cumulative effects considerations of options

For each option consider:

- Will this option have an impact on the selected valued resources?
- What are the potential cumulative effects?
- Are the effects likely to be significant?
- Are there other plans or actions relevant to this option that are likely to affect those resources?

6.4 At the level of broad options relating to spatial alternatives of development, CEA could be used to compare options by considering which option is likely to cause significant contributions to significant effects. An example of how the cumulative effects of alternative spatial strategies are set out in Table 8.

Table 8. Comparison of options considering potential cumulative effects

Options	Affected valued environmental resources	Other stressors	Potential cumulative effects Negative (-) Positive (+)	Likely significance Major or Minor Long or short term
1. Concentrated development through urban regeneration	Air quality Urban environment Urban open spaces	Existing traffic & congestion	- Increase in traffic & air pollution - Loss of urban open space rich in biodiversity + visual effects through better designed urban regen. schemes + redev of brownfield sites + preservation of countryside	Thresholds can be used to determine significance: Will increase in air pollution mean that the threshold is breached?
2. Concentrated development through urban regeneration & expansion of smaller towns	Air quality Urban open spaces & outlying areas	Existing traffic & congestion	- Increase in traffic & air pollution in urban and outlying areas - loss of open spaces, urban and countryside + visual effects through urban regeneration	
3. Devt through urban regeneration & expansion & new settlements	Air quality in urban areas Urban open spaces Open countryside	Existing traffic & congestion	- Increase in traffic congestion & air pollution in urban areas - loss of green spaces - induced developments near new settlement	How valuable is the land that would be lost in creating a new settlement?

7. Assessing the cumulative effects of the plan

7.1 Introduction

7.1.1 The SEA Directive requires that the effects on the environment should be assessed, including cumulative effects. In the Environment Report, the "*likely significant effects on the environment of implementing the plan ... and reasonable alternatives... are identified, described and evaluated*" (Article 5.1). Furthermore, the Environmental Report should include information that may "*reasonably be required taking into account current knowledge and methods of assessments, the contents and level of detail of the plan,... its stage in the decision-making process...*" (Article 5.2).

Information to be provided in the Environmental Report include:

- "*the likely significant effects on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors.*" (Annex 1 (f))

- "*These effects should include secondary, **cumulative, synergistic,** short, medium and long-term, permanent and temporary, positive and negative effects.*"
(Footnote, Annex 1 (f))

7.1.2 The assessment of cumulative effects are undertaken as part of the assessment of the plan's effects. However, considering cumulative effects extends the analysis of these effects in two ways:

- it focuses the analysis of effects on selected environmental resources
- it considers past impacts and future impacts relating to these resources.

7.2 Assessing potential cumulative effects of plan options

7.2.1 Determining the environmental effects involves describing the cause-effect relationships producing cumulative effects and summarising the total effect of each plan option. This requires identifying the main sources of stress, pathways of change and the environmental changes affecting valued resources. The main steps for predicting cumulative effects are:

- Identify and describe cause-effect relationships for valued resources;
- Determine environmental changes that affect these resources;
- Predict response of the environmental resource to change;
- Evaluate magnitude and significance of cumulative effects.

Identify and describe cause- effect relationships

7.2.2 Identifying cause-effect relationships between the stresses and valued resources requires determining stresses resulting from the proposed options and their likely effects on valued resources. For example, one option for housing provision is a regeneration strategy comprising high-density housing on brownfield sites near a river, which has been designated a Site of Nature Conservation Importance. The stresses/causes here are construction of housing units, roads and infrastructure while the valued resource is the river. Potential effects are disturbance and loss of habitats. The effects from these activities, and the effects from previous developments on the riverside and future activities could result in cumulative effects.

7.2.3 A useful method for identifying primary, secondary and higher order effects that can lead to cumulative effects is the network analysis method. Networks and systems diagrams can be used to conceptualise cause-effect relationships. Conceptual models can be developed using available data and expert knowledge. The cause-effect model can assist in identifying past, present and future activities and a number of activities in an area can be depicted as they interact, individually and in combination, with environmental components. Networks are a useful means of representing cumulative impacts as *"workable methods with practical application to local and regional planners and decision makers"*[40].

7.2.4 Network analysis traces interaction pathways between the elements of the environment, and can be used by the practitioner to select what aspects should be looked at in more detail or what further information is required for the assessment. Although the method is qualitative, it can provide a basis for choosing which elements need to be quantified or modelled in more detail. If there is sufficient data available, it may be possible to include quantitative measurements in the network diagram.

7.2.5 The basic component of network diagrams is the impact chain. Impact chains show the process of cause and effect, indicating secondary and indirect effects. These impact chains can be linked together to produce more complex diagrams. In order to apply the network analysis method to plans, various activities are required and these are listed in Box 10.

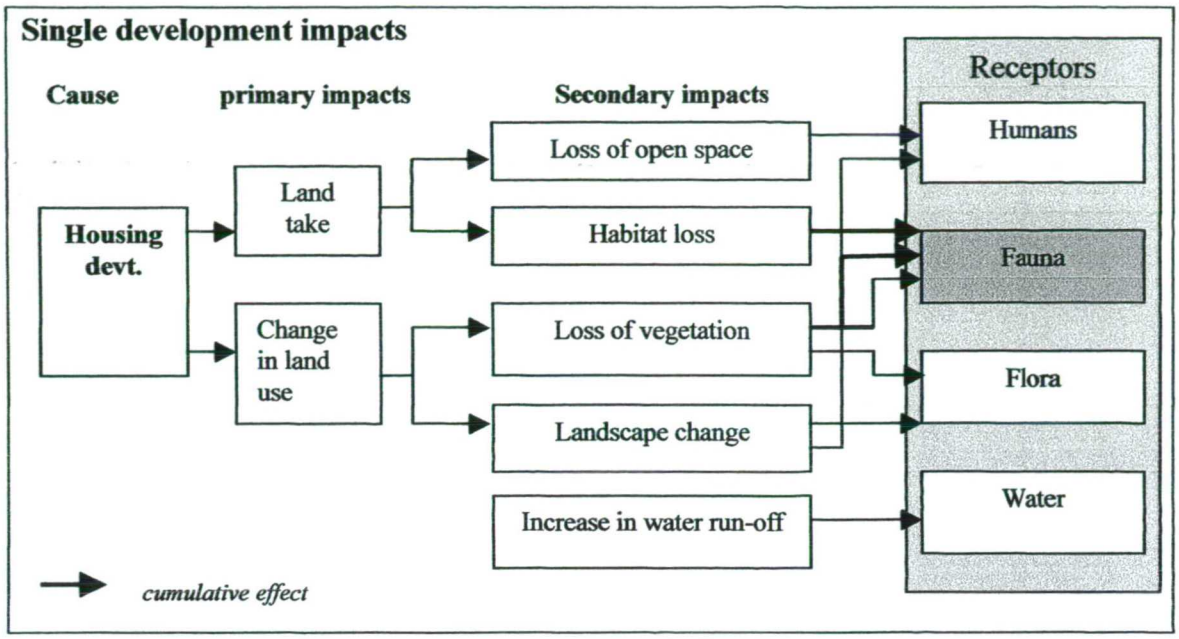
Box 10. Using the network analysis method to identify potential cumulative effects of plan options

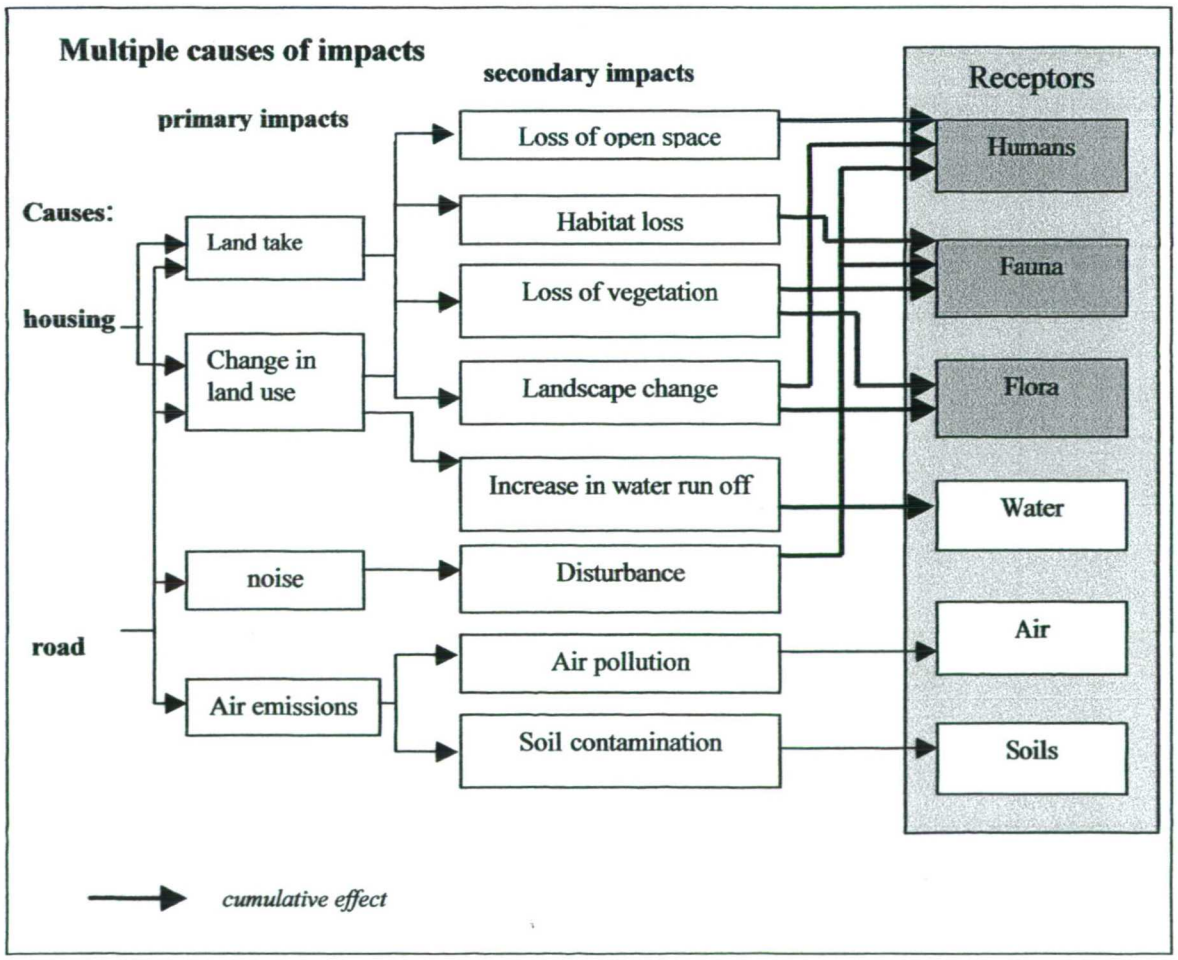
Steps in network analysis:
- List activities associated with the plan option (principal causes driving development in the plan area)
- Indicate the key impacts induced by these demands on the plan area
- Identify valued environmental resources or receptors
- Identify direct impacts of plan options on receptors
- Identify pathways of impacts
- Identify secondary and tertiary impacts on the main receptor and other receptors
- Identify other plans or actions that could impact on the same receptors

[40] Dixon, J and B Montz (1995). From concept to practice: implementing cumulative impact assessment in New Zealand. *Environmental Management.* 19 (3) p 455.

7.2.6 Examples of simple network analysis diagrams are shown in Figure 5. Other examples of network diagrams are included in Appendix 1.

Figure 5. Examples of network analysis diagrams





Determine the environmental changes that affect valued resource

7.2.7 Based on the network diagram which identified impact causing activities and potential impacts, the next step is to determine what are the environmental changes resulting from these activities that would affect the valued resource. This requires analysing the pathways of the impacts and impact relationships.

7.2.8 Using the example shown in Figure 4, the development of an area for housing leads to loss of vegetation and habitats and species. Both these impacts affect wildlife in the area: one pathway is direct (loss of habitats and species) and another pathway is indirect (loss of vegetation). Another example is increase in road traffic which results in increase in air pollution. One pathway is through the air while other pathways are through pollution deposition where contaminants deposit on vegetation and soil, which potentially affect vegetation (growth), wildlife (consumption of contaminated vegetation) and water quality (contamination).

Predict response of the value resource

7.2.9 To predict the response of the resource to environmental change, data on the status of the resource and trends are required. Monitoring data would be particularly useful in defining trends. Trends analysis can be used to model the effects over time. The response of the valued resource to cumulative impacts depends on several factors, such as the sensitivity of the resource and how close it is to the threshold, where additional impacts might cause the threshold to be breached. When quantitative data is available (e.g. noise or air pollution levels), it may be possible to predict impacts quantitatively.

7.2.9 Considering cumulative effects include the following[41]:

- the parameters for measuring the effects on the valued resources;
- what determines their present condition; and
- how would the proposed plan in combination with other existing or approved actions or plans affect their condition.

Evaluate magnitude and significance of cumulative effects

7.2.11 The magnitude and significance of cumulative effects need to be determined in the context of other past, present and future activities and thresholds. An appropriate baseline condition and threshold should be established, beyond which adverse impacts may occur. There are regulatory thresholds that can be used, such as those for air quality (for example, limits for NO_2 and PM_{10} were set by the EU Directive 99/30/EC) or for noise (Planning Policy Guidance 24[42] recommends noise exposure categories). Significance of effects can also be determined in the context of the SEA/CEA objectives identified earlier.

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[41] Hegmann,G and Yaranton, G (1995). *Cumulative Effects and the Energy Resources Conservation Board Review Process.* Prepared by the MacLeod Institute for Environmental Analysis for the Energy Resources Conservation Board, University of Calgary, Calgary, Alberta.

[42] DOE (1994). *Planning Policy Guidance: Planning and Noise.* London: HMSO.

7.2.12 The magnitude of cumulative effects on valued resources can be considered by initially determining the separate effects of past actions and present actions, the proposed plan and other future plans and actions. The cumulative effects on a specific resource will not necessarily be the sum of all the effects. The assessment will need to consider whether the effects will be additive, antagonistic or synergistic. The assessment can be summarised as shown in Table 9.

Table 9 - Description of cumulative effects on valued resources

Resource	Past Actions	Present Actions	Proposed Actions	Future Actions	Cumulative Effect
Air Quality	Air pollution impacts (No_2 and PM_{10}) from road traffic	Increase in pollution levels due to increase in road traffic	Further increase in road traffic but standards met	Increase in vehicle emissions expected	Standards for both NO_2 and PM_{10} breached causing human health problems (synergistic)
Habitats alongside an urban creek, a locally important site	Industrial developments and quays on creekside causing disturbance to wildlife	Loss of habitats from rebuilding of creek walls	Redevelopment of sites along creek causing loss of habitats	Continued loss of habitats	Significant cumulative loss of habitats and species (additive)

7.2.13 To determine the magnitude of impacts, indicators identified earlier can be used. Indicators provide a measure of the effects on a valued resource. Indicators can measure attributes of activities that lead to effects (e.g. road densities, area cleared) or attributes of surrounding environment (e.g. fragmentation indices, biodiversity indices). For some impacts, the magnitude can be quantified. For example, the area of land used for housing, area of habitat loss or the combined effect of noise from several sources. However, for some effects, such as visual impacts the cumulative loss of views may have to be described qualitatively.

7.2.14 The significance of effects should be evaluated beyond its local and direct effects. Factors to consider are context and intensity. The significance of the effects depends on the importance of the affected resource in terms of local, regional or national context. Intensity can be determined by using the following criteria: geographic extent, duration and frequency of the effects. Some questions for evaluating significance are listed in Box 11 below.

Box 11. Some useful questions for evaluating significance of cumulative effects:

- Will the proposed plan cause cumulative effects that might exceed thresholds as defined in regulations and guidance?
- Is the plan likely to affect an important resource or element of the environment?
- Is this valued resource subject to disturbance during existing conditions and to what degree?
- Will any cumulative effects be significant when taking into account the current state of the affected resource?
- Will there be an increase in the plan's effect on the valued resource in combination with the effects of other plans and actions?
- Will the resulting effect be unacceptable (exceed threshold)?
- Will the effect be permanent?
- If not permanent, how long will it take for the affected resource to recover?

- Will the cumulative effect induce other effects (secondary effects)?
- Can the effects be mitigated effectively?

7.3 Assessing the cumulative effects of plan policies and proposals

The analysis of the cumulative effect of plan policies and proposals involves identifying the main sources of stress, the pathways of change and their overall effect on the valued resources. The process is similar to assessing the impact of the plan option, but at a more detailed level, particularly in terms of the proposals. For example, interactions of proposals (housing and commercial developments) may cause cumulative effects on a particular resource (water).

7.4 Assessment Methods

7.4.1 There are a number of tools that can be used for predicting cumulative effects[43]. Some examples of tools for analysis are presented below in Table 10, which consist of simple and more complex tools. The use of the appropriate tool depends on several factors, such as the type of cumulative effect being investigated, expertise, resources and available data.

Table 10. Examples of assessment tools

Tools	Application
Impact models-networks or systems models	Detailed assessment of cause-effect relationships between action ands valued resource and impact interactions
Trends analysis	Assesses the status of a resource and changes in the occurrence or intensity of stresses over time.
Indicators of change	Select indicators of environmental quality for an area and establish an allowable target or threshold for this indicator, which is then used to evaluate the cumulative effects of existing and future developments.
Carrying capacity	Measures cumulative effects against threshold
Indices	Habitat indices or biological diversity indices
Scenario analysis	Predicting outcomes of various scenarios
Computer modelling	Quantifies cause-effect relationships leading to cumulative effects (e.g air, hydrological, water quality, noise, transport)
Spatial analysis using Geographic Information System (GIS)	Can analyse landscape parameters and identify where effects are worse. It can quantify results of actions (e.g area of land cleared) and changes to landscape features (e.g. loss of woodland)
Tables and matrices	Evaluation and comparison of variables
Checklists	Can show whether the plan has an impact and impact type

7.4.2 Some of these tools are already used in planning (e.g. carrying capacity, scenario analysis, modelling and GIS) and sustainability appraisals (e.g. tables and matrices and use of indicators). PPG 12, for example, recommends the use of GIS. Spatial analysis using a Geographic Information System (GIS) involves

[43] The US CEQ Guidance (1997) *Considering Cumulative Effects* lists primary and special methods for analysing cumulative effects.

assessing the effects of the proposed action on a component of the environment, using an overlay technique.

7.4.3 An example where GIS was used is the research commissioned by the Countryside Council for Wales to develop a methodology for cumulative effects assessment for offshore industries. Here, GIS was used to overlay data related to baseline environment and projected activities[44]. GIS is a powerful tool for analysing cause-effect relationships, allowing large areas to be investigated and quantifying results. However, descriptive data in spatial form is necessary and compatibility of data from various sources is an issue. If planning data is available in GIS format, this is a method that would be worth considering.

[44] Oakwood Environmental Limited (2002) *op cit.*

8. Mitigation measures

8.1. Introduction

The SEA Directive refers to mitigation measures and their documentation.

> Information should be provided on: "*the measures envisaged to prevent, reduce and as fully as possible offset any significant adverse effects on the environment of implementing the plan or programme*"
>
> SEA Directive (Annex 1f)

8.2 Types of mitigation measures

8.2.1 SEA provides a huge opportunity to address potential cumulative effects, particularly those relating to irreversible loss or damage. Addressing these effects over a larger geographical area allows a more accurate and realistic assessment of these effects. SEA also permits advanced mitigation of potential cumulative effects from developments. CEA assists in this process by highlighting resources at risk and therefore promotes avoidance of effects.

8.2.2 Mitigation measures to deal with cumulative effects require an analysis of the cause-effect relationships which lead to cumulative effects. This means determining which of the cause effects pathways results in the most effect. By analysing pathways, measures to mitigate impacts can be identified as shown in Box 12.

Box 12. Types of mitigating measures

Avoidance
Measures taken to avoid adverse cumulative effects, such as selection of options where proposed developments are located away from protected areas, highly sensitive areas or highly built-up areas approaching environmental thresholds.

Mitigation
Measures taken to reduce adverse cumulative effects from road traffic (e.g. congestion, noise and air pollution) policies can be introduced such as: limiting road parking, promoting use of public transport, providing cycle lanes and pedestrian pathways. In some regeneration plans (Kent- thameside and Ebbsfleet, Creekside and Millennium Quarter) the cumulative impacts of traffic were addressed through the use of such policies.

Compensation or offsetting
Measures taken to compensate effects which cannot be mitigated. For example, loss of open space to developments (commercial and housing) can be off set by providing a public plaza, which is accessible to local residents. The cumulative loss of urban habitats can be compensated for by requiring 'green or brown roofs' in urban regeneration developments, such as those in the Creekside area of the London Boroughs of Greenwich and Lewisham.

Enhancement
Enhancement means improving the present environment. Positive cumulative effects, such as provision of walkways, cycle ways and public transport in urban regeneration schemes cumulatively provide a better environment.

8.3 Proposing mitigation measures

8.3.1 Cumulative effects can occur over a large area and over a long period of time. It is usually due to several factors and so mitigation measures need to be at a strategic level. To be effective, mitigation measures at the plan level should be long term and area-wide or regionally based and should rely on inter-agency efforts to mitigate regional or area wide effects. An example is the cumulative effects of air pollution from transport, which cross local authority boundaries and require co-operation between the relevant authorities. Mitigating ecological effects may also need inter-agency coordination. In this context, there is a need to mitigate to agreed standards and thresholds. An example of partnership approaches to mitigate cumulative effects is demonstrated in some urban regeneration strategies as shown in Table 11.

Table 11 Mitigating cumulative effects through a partnership approach

Case	Effect	Mitigation measures	Partners
Creekside regeneration	Loss of habitats and species; disturbance of species from multiple developments and rebuilding of Creek walls	Ecological survey of area before development; Proposals for intertidal areas, brownfield roofs for habitat compensation and creation; Proposals for monitoring of habitats and species; Proposals for river wall enhancements	Local planning authorities (Greenwich and Lewisham Councils); Local ecology group; Local forum; Environment Agency; Local organisations and individuals; Riverside owners; Creekside regeneration programme;
Ebbsfleet Valley	Transport impacts from increase in population due to new developments in the area: transport infrastructure, commercial and housing	Transport strategy by Kent-thameside to promote use of public transport and less car use; Development of transport model to assist assessment of transport effects; Promotion of green corridors for walking and cycling	Local planning authorities (Dartford and Gravesham Councils); Kent thames-side partnership; Kent County Council; Landowners; Developers and other organisations

8.3.2 Mitigation of potential cumulative effects during the SEA process can be undertaken through the selection of more sustainable options - those with the least cumulative impacts. Some tools that planning authorities can use to mitigate cumulative effects at strategic level include: amending policies; use of supplementary planning guidance; preparing planning and environment frameworks for areas likely to have potential for cumulative effects and setting relevant criteria for evaluating development proposals for planning permission. In Ebbsfleet, for example, mitigation measures to address impacts were proposed at strategic level and these are shown in Box 13.

8.3.3 Mitigation measures can include habitat creation in another part of the plan area or region. The concept of "no net loss" has been put forward as an appropriate mitigation measure for regional cumulative effects. No net loss requires that any

land or waterbody, which has been affected should be replaced with an equivalent area so that the capability of habitat to support wildlife or fish is maintained in the region[45].

Box 13 Mitigation measures at strategic level

Mitigation measures under Policy MDS1 Ebbsfleet[46]:

- creation of a network if Green Grid spaces/links to provide a high degree of public access in throughout the area
- establishment of community woodlands to mitigate change in landscape character;
- retention and enhancement of water courses and habitats;
- development of area designed around the presence of power lines in order to ensure safety and visual amenity for the new population living and working at Ebbsfleet;
- developing criteria for evaluating impacts of project proposals seeking to gain planning permission;
- adopting policy which reduces the need to travel by private car (no more than 37% of work journeys to and from the development excluding to the station) and encouraging travel by more energy efficient means;
- concentration of developments at nodal points and along public transport corridors;
- extensive managed public open space;
- phasing of proposals in the area so that facilities grow in line with and not in advance of the needs of the new community.

8.4 Evaluating significance of residual impacts

Although mitigation measures for the plan, policies and proposals could be proposed, there will inevitably be some residual effects. There is a need to assess the significance of residual impacts because they could lead to cumulative effects. The approach for determining significance (discussed in Section 7.2.9) can be used. The predicted residual impacts should be compared against regulatory thresholds and SEA objectives.

[45] Hegmann et al (1999) *op cit.*

[46] Dartford Borough Council (2002) Local Plan Review, Second Deposit Draft.

9 Monitoring

9.1 Introduction

The SEA Directive requires that significant effects which includes cumulative effects should be monitored, as stated below.

> *"Member states shall monitor the significant environmental effects of the implementation of plans and programmes in order, inter alia, to identify at an early stage unforeseen adverse effects and to be able to undertake appropriate remedial action."* (Article 10.1)
>
> Information to be provided in the environmental report should include: *"a description of the measures envisaged concerning monitoring in accordance with Article 10"*. (Annex 1,i)
>
> SEA Directive

9.2 Proposing monitoring of cumulative effects

9.2.1 The ODPM's Guide to Plan-making[47] states that the establishment of an appropriate monitoring mechanism by working with partners is basic to the plan preparation and delivery process. The monitoring programme of the plan's effects should include the monitoring of the overall cumulative effects on valued resources. The SEA guidance suggests that indicators used for describing the baseline environment and making SEA predictions should be used. In monitoring cumulative effects, the indicators used for describing the baseline of the valued resources should be used.

9.2.2 Because of the complexity of cumulative effects problems at a strategic level, there will be a great deal of uncertainty about impact predictions and so monitoring is critical in order to:

- assess the accuracy of the predictions and
- to monitor the effectiveness of mitigation measures.

9.2.3 Monitoring is important because it can be a means of assessing causality and improve forecasting abilities. This requires however, that indicators used in the monitoring should be the same as those used in the CEA. In addition, monitoring allows the planning authority to evaluate and improve impact management performance.

9.2.4 Steps in developing a monitoring programme are listed in Box 14. The first five steps are undertaken during the CEA and SEA. The implementation of the monitoring programme occurs during the plan implementation.

[47] ODPM (2002) *op cit.*

Box 14. Designing and implementing a monitoring programme for cumulative effects[48]

Component	Tasks
1) Identify and define main cumulative effects	- Identify significant cumulative effects to be monitored and scope.
2) Coordinate with agencies in developing a monitoring programme	- Identify relevant agencies with monitoring responsibilities in the affected area; - Identify agencies' areas of concern and relevant type of cumulative effects they are responsible for; - Identify each agency's authority for controlling cumulative effects: planning, decision-making, monitoring or enforcement. - Decide roles and responsibilities of agencies involved.
3) Define monitoring objectives	- Define objectives relating to potential effects; - Define objectives relating to the affected resources in terms of the CEA and SEA objectives; - Define purpose of monitoring: to monitor effects, mitigation measures and to establish baseline conditions for future assessments.
4) Determine data requirements	- Select measurable indicators to assess the magnitude of change; - Decide on frequency and timing of data collection. Frequency relates to what is required for trend analysis, enforcement of regulations and correlation of cause and effects. Timing relates to the timing of activities causing the cumulative effect. - Select monitoring areas based on the location of activities causing cumulative effects and areas most likely to be affected. - Determine method of data collection (e.g. for vegetation cover field or remote sensing techniques) and method of analysis; - Determine data storage and format.
5) Develop implementation plan and agencies responsible for various elements	- Determine budgetary, personnel and time requirements for obtaining and analysing data; - Determine feasibility and if the programme has to be reduced, there are some approaches that may be useful: reduce scope of monitoring; alternative indicators selected; frequency of data collection reduced or alternative data collection methods selected.
6) Collect and analyse the monitoring data	- Identify baseline condition and effects trends and rate of change. - Identify cumulative effects that have reached critical levels and those that have exceeded legal limits. - Evaluate effectiveness of mitigation measures
7) Implement management activities to manage or mitigate adverse cumulative effects	- Plan responses to cumulative effects trends. Responses to unacceptable effects can be directed at the activity causing effect or the effect itself. - For effects that have reached critical levels: stop or modify activities causing effects and address effects. - Mitigation measures can be revised, terminated or new ones can be added as appropriate
8) Prepare periodic monitoring reports	- Prepare reports at regular intervals to document the monitoring programme, key environmental trends and response actions.

[48] adapted from Canter, L and R Clark (1999). *Cumulative Effects Assessment*. IAIA Pre-meeting Course (June 13-14, 1999) Handbook. Glasgow.

10 Documentation of findings on cumulative effects assessment and consultations on the Environmental Report

The findings on potential cumulative effects should be included in the relevant parts of the Environmental Report: baseline conditions, environmental characteristics of areas to be affected (selected valued resources), existing environmental problems (cumulative effects issues), assessment of effects, mitigation measures and proposed monitoring programme. Any comments on cumulative effects aspects from consultations should be taken into account in any revisions to the Environmental Report.

11 Quality assurance for cumulative effects considerations

11.1 The SEA Directive requires that Member states should ensure that environmental reports are of a sufficient quality to meet the requirements of the Directive and should communicate to the Commission any measures taken concerning the quality of the reports (Article 12.2). In order to determine whether cumulative effects considerations have been integrated into the SEA process, a set of criteria is presented in Appendix 2. A good quality SEA should deal adequately with cumulative effects during each stage of the process. Failure to do so may mean that significant effects could result from the plan.

11.2 The Quality Assurance checklist can be used by anyone involved in the SEA or the planning process who is concerned about how cumulative effects are being addressed in that process: the planning authorities that undertook the SEA, consultees, organisations or members of the public. It is designed to be part of the Quality Assurance for the SEA but focusing on cumulative effects.

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Glossary

Additive effects: sum of all the impacts

Cause-effect relationship: The relationship between an action's disturbance (cause) and its effect on the environment.

Cumulative effects: effects that result from incremental changes caused by the plan together with past, present and future actions.

Cumulative Effects Assessment: an assessment of the incremental effects of an action or plan on the environment when the effects are combined with those from other past, existing and future actions.

Environmental Assessment: a tool for integrating environmental considerations into decision-making by ensuring that significant environmental effects of the decision are taken into account.

Impact: any aspect of an action that may cause an effect: for example land clearing during construction is an impact whilst a possible effect is loss and fragmentation of wildlife habitat.

Indicators: measures the condition of the resource of interest, used as variables in the modelling of changes in environmental systems over time.

Monitoring: a continuing assessment of conditions relating to an action.

Network Diagram: an illustration of cause-effect relationships between an action's impact and an effect.

Neutralising effects: impacts counteract each other, thereby reducing the overall impact

Residual effects: effects that remain after mitigation has been applied.

Scoping: process for identifying the main issues and selecting the valued resources to be examined in the CEA, the temporal and spatial boundaries for the study and deciding methods and approach to use.

Secondary (and tertiary effects): effects that are consequential from direct or primary effects of the action

Strategic Environmental Assessment: environmental assessment as applied to policies, plans and programmes.

Sustainability Appraisal: a form of assessment used in the UK (for RPGs and development plans) to consider social, economic and environmental effects.

Synergistic effects: cumulative effects that result when the interaction of a number of impacts is greater than the sum of the individual impacts. Some examples:

- the combined impact of construction noise from various developments is greater than the sum of the individual noise impacts.
- when a different type of impact occurs from the original impacts, such as the combination of SOx and NOx produces smog

Threshold: A limit of tolerance of an environmental resource to an effect, which if exceeded, results in an adverse response by that resource.

Valued Environmental Resource: any part of the environment that is considered important by the stakeholders, public, the scientific community or the government involved in the assessment process. Importance can be determined by cultural values or scientific concern.

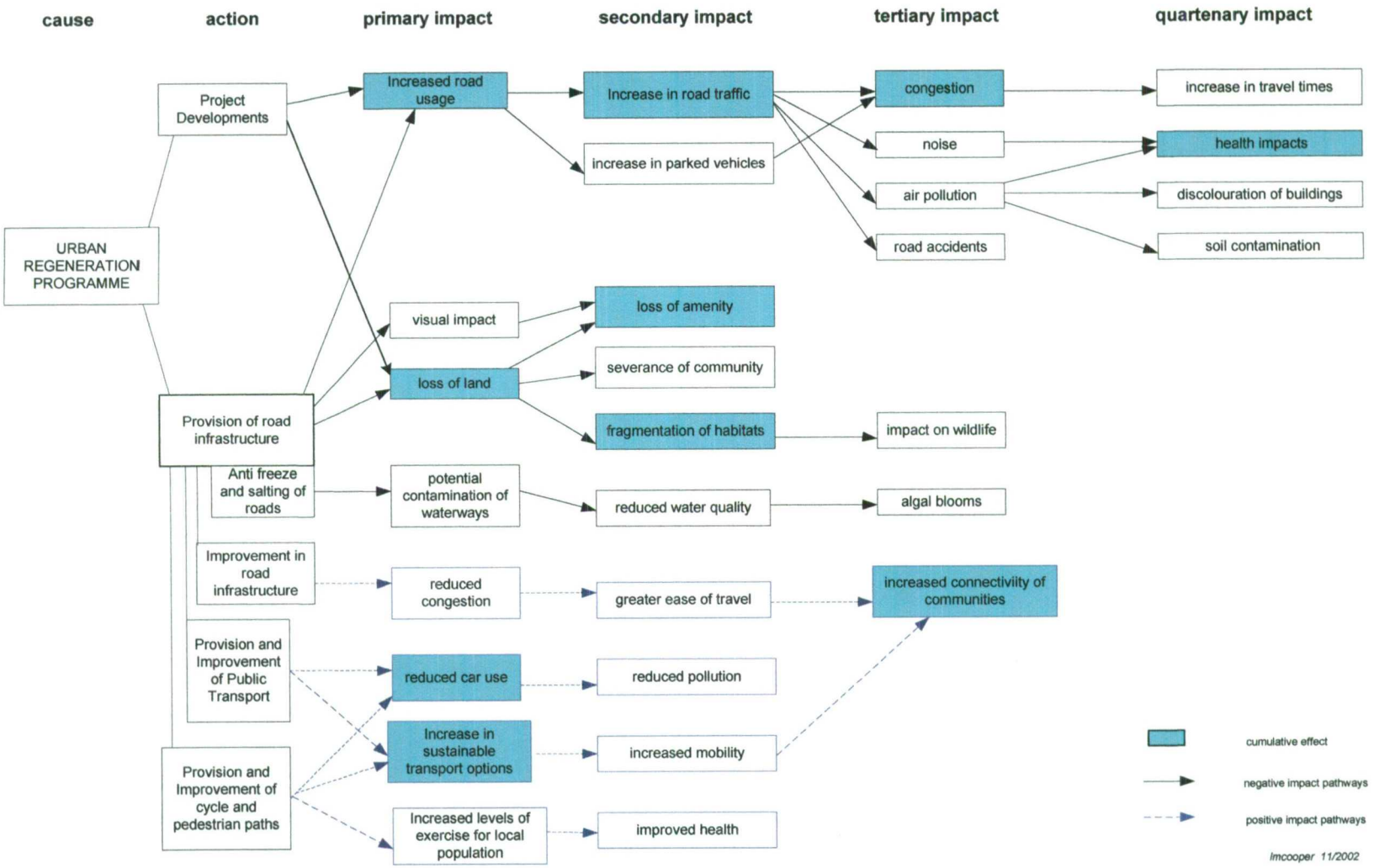
Appendix 1. The network analysis method[49]

Two examples of network analysis diagrams are presented here:

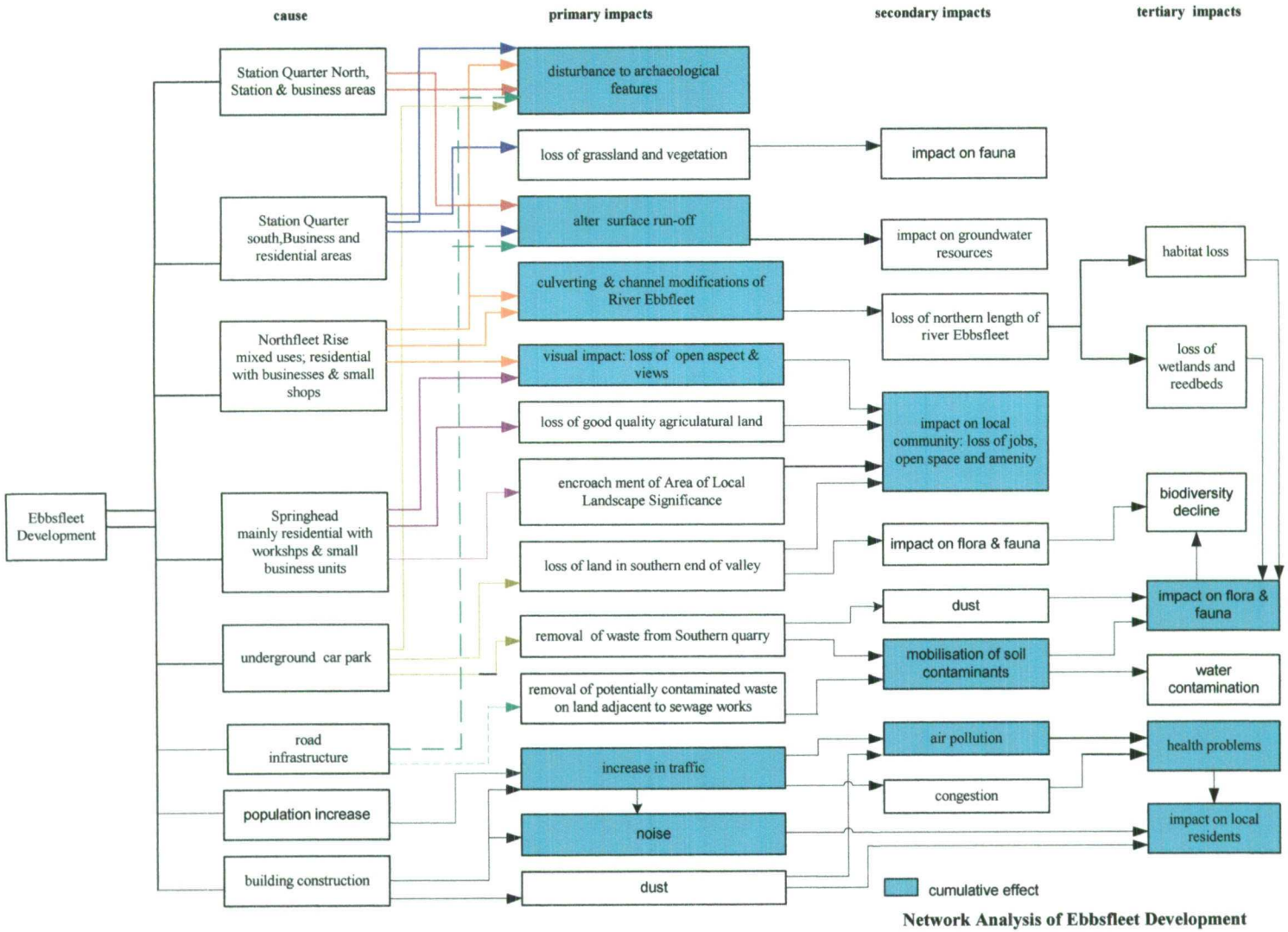
1) Network Diagram 1 demonstrates the use of network analysis in illustrating the cumulative impacts of urban regeneration on transport.

2) Network Diagram 2 indicates potential cumulative effects of a regeneration plan. This example is based on the proposed Ebbsfleet Development in Ebbsfleet Valley, located in Dartford and Gravesham. Ebbsfleet Development is a mixed-use development consisting of an international station, housing and commercial areas.

[49] Other examples of network diagrams can be found in: Hyder Consulting (1999). *Guidelines for the assessment of indirect and cumulative impacts as well as impact interactions*. Brussels: European Commission – DGXI. (available at: http://europa.eu.int/comm./environment/eia/eia-support.htm and in Court, J, C Wright, A Guthrie (1994). *Assessment of Cumulative Impacts and Strategic Assessment in Environmental Impact Assessment*. Prepared for the Commonwealth Environmental Protection Agency, Canberra.



Potential cumulative effects of development and transport provision



Network Analysis of Ebbsfleet Development

Appendix 2 - Quality Assurance Checklist[50]

Evaluation criteria to assess the integration of CEA into the SEA and plan-making process, which should be addressed as the SEA process progresses.

Criteria for efficient scoping

1. Were **cumulative effects** mentioned or discussed?
2. Were **spatial boundaries** delineated to address cumulative effects?
3. Was the **time frame** long enough to allow detection of possible cumulative effects?

Criterial for effective baseline description

4. **Were all** plans and activities individually or cumulatively **affecting the resource identified?**

5a. Were the effects of **past, present and foreseeable future** actions identified?

5b. Were actions analysed?

Criteria for determining environmental consequences

6. Were all possible **aspects of the plan** considered?

7a. Were all possible **stresses/impacts/effects** on the resource identified and characterised?

7b. Were all **potentially affected resources** considered?

7c. Were **individually minor effects or multiple actions over time** considered?

7d. Were the **effects quantified?** If effects cannot be quantified, **were qualitative analyses conducted?**

7e Were **delayed or secondary effects** assessed?

7f. Were possible **effects away from the source** identified?

7g. Were **additive or synergistic effects** evaluated?

8. Was the **environmental threshold, pollution climate or baseline conditions** fully understood or established?

8. Was there a focus on **resource sustainability**?

9. Were **tools** used to evaluate cumulative effects (e.g. network analysis, carrying capacity, ecosystem analysis)?

10. Was **loss or fragmentation of habitats** a consideration?

Criteria for mitigation and monitoring

11. In mitigation recommendations, were **alternatives recommended** to mitigate cumulative effects specifically?
12. Were possible cumulative effects included in the **monitoring or management plan?**

Criteria for consultations and stakeholder involvement

13. Were consultations on cumulative effects considerations held **during scoping?**
14. Were the **consultees, stakeholders and the public** provided with the opportunity to comment on the **draft plan, draft environmental report and the CEA findings?**
15. Were the **findings of the CEA** made available to the consultees, stakeholders and the public?

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[50] modified from Kotze, I (2001). *Integrating the Assessment of Cumulative Effects into Environmental Impact Assessment and Strategic Environmental Assessment in South Africa.* Environmental Assessment Yearbook 2001. Institute of Environmental Management and Assessment and the EIA Centre (University of Manchester).

SECTION V – DISCUSSION AND CONCLUSIONS

Chapter 13 Discussion

13.1 Introduction

The research problem addressed in this thesis was:

Cumulative effects are not considered adequately in the UK planning and environmental assessment processes.

From this, the general research question was formulated: *How could CEA be applied more effectively in the planning and assessment process?* To explore this question, four detailed research questions were formulated and a methodology was designed to answer them (Chapter 2). The detailed research questions were investigated in Chapters 5 to 9. The results of these investigations and findings from the literature review informed the preparation of the final framework (Chapter 12). The framework signifies an answer to the general research question. This chapter initially reiterates the four detailed questions and discusses the research findings relating to each. Subsequently, a number of issues relating to the development of the framework are discussed.

13.2 The detailed research questions

The four detailed research questions formulated were:

1) *To what extent and how were cumulative effects considered in environmental assessments at project and strategic levels?*

2) *What changes in the environmental assessment and planning processes are necessary to ensure that CEA is applied effectively?*

3) *How could CEA be integrated into the strategic planning process?*

4) *Could a framework that incorporated CEA into the SEA and strategic planning processes be developed which could assist planners and practitioners to consider cumulative effects more effectively?*

Consideration of the literature and analysis suggested that the problem could be due to the lack of: understanding of the concept, appropriate framework, guidance and

methods. The first refers to a problem of definition while the rest are procedural. To define the research problem further, reviews of current practice were carried out.

The first detailed research question was investigated through a review of a sample of 50 project EIAs and 15 environmental/sustainability appraisals as discussed in Chapter 6. The review of project EIAs found that cumulative effects were seldom addressed. There were various interpretations of the concept and when cumulative effects were considered, the assessment was generally limited to the site and immediate area. The limitations of addressing cumulative effects were identified: those relating to CEA in general and those relating to project EIAs in particular. General problems were the lack of common understanding of the concept, uncertainty in regulatory requirements, lack of appropriate guidance and access to information on other relevant developments that should be considered. Guidance on CEA has been issued in several countries and in Europe (US CEQ, 1997; Hegmann *et al*, 1999 and Hyder, 1999) but as some EIAs had stated, the lack of guidance specific to the UK context was a hindrance.

In terms of the EIAs themselves, their limitations related to the fact that EIAs are prepared in order to gain planning permission for a specific site. Thus, the focus of the assessment is on the direct effects of the project. As Sadler and Fuller (1999) observed, project EIAs operate within limited time and space frameworks to adequately address cumulative effects. However, there are indications that more recent EIAs have started to pay more attention to cumulative effects. This could be due to two factors: an increasing awareness of these issues by planners and more scoping being undertaken due to the EIA Regulations in 1999[19] which required planning authorities to provide a scoping opinion should the developer request one. When cumulative effects issues were included in scoping then they were more likely to be considered later on in the assessment. But the assessments were usually limited in terms of area and time period.

Previous studies have found that project EIAs consistently failed to consider the cumulative effects of development and suggested that SEAs or environmental appraisals may provide a more appropriate context for addressing such effects (RSPB, 1995). Then again, the review of environmental/sustainability appraisals revealed that

[19] Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI No. 293).

cumulative effects issues are rarely addressed. Cumulative effects were mentioned in only two appraisals. Hence, consideration of the first detailed research question by undertaking reviews of EISs and environmental/sustainability appraisals provided compelling evidence that cumulative effects are poorly considered.

The second detailed research question investigated was: W*hat changes in the environmental assessment and planning processes are necessary so that CEA can be applied more effectively*? The literature reviews revealed the lack of appropriate framework and systematic procedures for considering cumulative effects and that cumulative effects are better considered at the strategic level. The next step was to investigate whether there were other tools that planners use to address cumulative impacts. The planners' toolbox at strategic level includes development plans, supplementary planning guidance and appraisals. An analysis of current procedures for appraising plans (environmental and sustainability appraisals), however, revealed that these procedures do not allow consideration of these effects.

The methodology for environmental appraisal (DOE, 1993) attempts to deal with cumulative effects, such as the impact of development on carbon dioxide emissions by setting global sustainability goals but the approach is very much based on " *best guesses rather than an accurate assessment of cause and effect*" (Dodd, 1996, p.5). This suggests that part of the problem is procedural. There are two essential elements in assessing cumulative effects: they need to be assessed against a baseline and trends and cause-effect relationships need to be analysed. Appraisals do not allow for this since impacts are appraised against objectives and baseline conditions for the valued resources are not established. Furthermore, their focus is to appraise compatibility among policies.

Bedfordshire County Council/RSPB (1996) noted these failings of the Environmental Appraisal procedure: failure to account for the cumulative effects of individual projects and failure to account for the overall environmental effects at an early enough point in the process. Their Step-by-step guide to Environmental Appraisal states that "*an environmental appraisal allows specific environmental impacts of policies/objectives, as well as total and cumulative effects, to be demonstrated*" (Ibid, p. 6) but did not specify a procedure for doing so.

Similarly, guidance for sustainability appraisal (DETR, 2000; Town and Country Planning Association, 2002) refer to the need to consider cumulative effects but do not specify how to appraise such effects.

SEA guidance documents (ODPM, 2003 and Scottish Executive, 2003) deal with cumulative effects briefly in their respective appendices and suggest the use of matrices to assess cumulative effects. The Scottish advice, which follows the environmental appraisal procedure, recommends the use of a cumulative impact assessment schedule or matrix of proposals that could contribute to cumulative effects and assessing their effects on key environmental resources. It suggests looking for repetitive patterns of symbols across the matrix to indicate cumulative effects but does not provide any detailed or systematic procedure on how the assessment should be done.

The ODPM SEA guidance explains cumulative effects as the sum of alternatives or policies, which does not take into account the synergistic or compounding nature of some cumulative effects. It proposed a matrix of alternatives and policies set against SEA/sustainability objectives. There are three problems with this approach. Firstly, cumulative effects relate to the valued resources and this has not been recognized in the guidance. Secondly, cumulative effects are appraised against objectives, which does not really address incremental impact on a valued resource. Thirdly, since valued resources and their baseline are not established, it would be difficult to determine the significance of cumulative effects.

A common weakness in the above guidance is the lack of systematic procedure for addressing cumulative effects during the SEA. They do not focus on valued resources, establish baseline conditions for those resources nor take into account exogenous factors or other actions (past, present and future) affecting those resources. If the requirements of the SEA Directive are to be met regarding cumulative effects, there is a need for a systematic and detailed procedure and guidance on CEA in SEA of plans.

The third research question therefore was: *How could CEA be integrated into the planning process*? This was investigated through an interview survey of 28 planners, experts and practitioners. To summarise, most of the interviewees were of the opinion that CEA should not be a separate exercise but should be part of sustainability appraisals and SEAs. Fourteen of the interviewees were in favour of incorporating

CEA into SEA. The interviewees were also consulted on cumulative effects concepts and useful features of a CEA. Half of the interviewees suggested that CEA should be integrated into all planning levels while the rest identified other levels and most of these preferred the local plan level.

In the light of the interview findings, a draft framework was prepared for incorporating CEA within SEA, taking into account best practice in CEA and SEA; the plan-making process; findings from the first interview survey; the requirements of the SEA Directive and SEA Guidance for England[20].

In preparing the Framework, one of the problems to be addressed was the lack of understanding of the concept. It was decided to focus on one sector, urban regeneration, because they illustrate cumulative effects well. Urban regeneration is a national policy that has to be translated into policies and proposals by local planning authorities. Most strategies are mixed-use developments in built up areas implemented within a particular area and time period, with potential for cumulative effects such as space and time crowding. Also there are few studies on environmental effects of urban regeneration, where the emphasis has traditionally been on social and economic impacts. Since cumulative effects should be considered within a context, the Thames Gateway, an area of national priority for urban regeneration was chosen to provide such a context.

To answer the fourth research question, *Could a framework that incorporated CEA into the SEA and strategic planning processes be developed which could assist planners and practitioners to consider cumulative effects more effectively?* the draft CEA framework was evaluated in two ways:

- Questionnaire evaluation by participants in the planning and SEA/SA process
- Application to case studies

Thirty three evaluation questionnaires were sent to some of the interviewees from the first survey and other practitioners who are involved in strategic planning, SEA and appraisals. The findings from the questionnaires revealed that the content and the framework itself were found to be useful but there was a need to clarify further the relationship between CEA and SEA and adapt it more closely to the UK context. Other

[20] The Interim Planning Advise for Environmental Assessment of Development Plans (SEA draft guidance for Scotland) was not issued until August 2003 while the draft CEA framework was prepared starting November 2002.

comments included the need to provide more examples of cumulative effects, and to expand mitigation and monitoring elements.

The draft framework was evaluated further by applying it to sub-case studies in the Thames Gateway to see how it could be used in actual cases of planning practice. The themes for analysis were: approaches, processes and methods. Detailed information on the cases and case study interviews were used to identify approaches and processes for dealing with cumulative effects. The purpose of the case study application was: i) to ascertain aspects of planning practice where the Framework could improve consideration of cumulative effects and ii) to test its feasibility and practicability.

The findings revealed the following case study approaches:

- CEA study approach as demonstrated in the Millennium Quarter;
- 'Development control' approach as shown in Creekside
- 'Development control with strategic elements' in Ebbsfleet;
- Cumulative Environmental Appraisal in SEA approach in the Thames Estuary Flood Risk Management Plan.

A comparison of these approaches with the proposed framework revealed some weaknesses and strengths in the case studies. The results are discussed in Chapter 11. Although each case study offered something different in terms of approach, none had assessed cumulative effects strategically, systematically and early enough in the planning process. Although the Environment Agency's TEFRM Plan integrated the SEA/SA process into plan preparation, the CEAp of option selection and policy development takes place during phase 4, to assess whether the preferred option is likely to cause significant contributions to significant effects. The CEAp refers to appraisal rather than assessment, which suggests that the effects are to be appraised against objectives. As discussed in Chapter 9, assessment of cumulative effects requires that baseline conditions and trends for selected resources are established and the appraisal process, which is based on objectives, does not allow this. Thus, none of the case studies adopted an integrated, systematic and rigorous procedure as proposed in the draft Framework. However, the case studies pointed to areas where the draft Framework could be improved by revision and good practice examples from the case studies were incorporated into the Final Framework.

Another element in the application of the framework was the testing of the network analysis method. Cumulative effects, potential and actual were identified based on planning reports, EISs, studies and case study interviews. Thus, the nature of these cumulative effects, geographical and temporal scope, the resources affected and their likely significance were explored. Linkages between impacts were identified in constructing the diagrams. Cumulative effects in urban regeneration were identified: noise, transport, ecology, waste and water resources and discussed in Chapter 10. The network analysis method allowed conceptualisation of potential impacts and impact relationships, which lead to cumulative effects. Draft network diagrams were shown to interviewees who made suggestions on their content and presentation. Some interviewees suggested that it could guide data collection and organisation of information and used as a heuristic tool for conveying the concept of cumulative effects in a way that decision-makers and the public can understand.

The results of the questionnaire evaluation and application to case studies revealed that the CEA framework would be useful and could potentially improve consideration of cumulative effects in SEAs and strategic planning. Consideration of the features of the Framework and planning practice revealed that integrating CEA into the SEA and the planning process is feasible and that the network analysis method is a practical tool that planners can use.

The findings from the evaluation questionnaire and application to case studies formed the basis for the revision of the framework. As a result of the evaluation process, substantial changes were made to the draft framework and a final framework proposed. The Final Framework provides an answer to the general research question by proposing a systematic process for addressing cumulative effects within the SEA process. Thus, the results of this research provide compelling evidence to support the proposition of this thesis that: *A framework that systematically integrates CEA into the strategic environmental assessment and plan-making process and provides adequate guidelines to planners and practitioners could assist in more effective consideration of cumulative effects in the planning process.*

13.3 The CEA framework: strategic, holistic and systematic

The CEA framework provides a strategic and systematic process for integrating cumulative considerations during the various stages of the SEA, from scoping; impact

identification; prediction and evaluation; mitigation; monitoring and quality assurance. It can strengthen the SEA process and be applied to SEAs of plans at different scales, such as regional, local development plans and action area plans. The case study aspect of the framework development played an important part in ensuring that it can be applied to different scales of plans, from sub-regional to local ones. Furthermore, the Framework could be applied to SEAs of other types of plans, such as management plans (as shown in its application to the Environment Agency's TEFRM Plan SEA).

The Framework could also be applied to SEAs of sub-local plans. The SEA Directive requires that an SEA be prepared for plans when they determine the use of "small areas at local level" and are likely to have significant effects (CEC, 2001). The Planning and Compensation Act refers to the preparation of area action plans for "key areas of change or conservation" containing detailed policies, proposals or guidance. Where there is likely to be significant effects from environmental changes in an area, then cumulative effects may be an issue. The Millennium Quarter is a small area where urban regeneration meant changes to the environment that led to potential cumulative effects. The application of the framework to the case studies has identified where the Framework could assist in addressing cumulative effects more effectively. Improvements to the case studies if the framework had been applied are discussed in Chapter 10.

The Framework is holistic because it incorporates both effects-based and stressor-based approaches. Most existing CEA approaches focus on a stressor-based approach, predicting effects of a project (Dube and Munkittrick, 2001). This Framework proposed the identification of thresholds and carrying capacity of the valued resources to establish a baseline and assess their sustainability. The analysis is then extended to assessing additional impacts from the proposed plan policies and proposals.

The Framework proposed a procedure that systematically addresses cumulative effects from the earliest stage of the SEA and plan preparation to the review of the process. The quality assurance checklist potentially provides a way for participants in the planning process to assess if cumulative effects have been considered. Thus, the consultee from English Nature who evaluated the draft framework commented that certain tables and the quality assurance checklist are "*very helpful - as these could be adapted for use in advising and later checking that where appropriate, cumulative*

effects have been factored into the process and not ignored by plan makers in their strategic environmental assessment".

The proposed Framework is practical and feasible. As Damman et al (1995) suggested, to be practical, CEA methodologies must be 'doable' given the available information, time and financial resources. The Framework can be applied using data that the planning authority and other agencies already hold. For example, local planning authorities have data on air quality and traffic. Other agencies hold useful data (e.g. Environment Agency-water quality monitoring data; English Nature and RSPB - data on designated sites). For locally valued resources, as shown in the Creekside case study, baseline conditions can be established by undertaking surveys which did not require extensive resources but provided data on selected resources. Where data is not available to undertake an assessment, the Framework can help identify what is required. The Framework proposes the network analysis method, which can be applied using available data and expert judgement. It also proposes other tools to establish the status of the valued resource against environmental thresholds and predict whether the additional impact is likely to be significant. These tools can be used along with network analysis and are already used in planning: capacity studies, limits of acceptable change and the quality of life methodology (see Chapter 5).

The CEA is undertaken during the SEA process by extending the analysis of effects on valued resources and so it is feasible. The development of the Framework has gone through a rigorous process, informed by consultations with experts and potential users: during the preparation (first interview survey) and during its evaluation (questionnaire evaluation and case study interviews). Consultations with end users tested its applicability and usefulness. Most of the respondents (99%) found the draft guidelines useful. In fact, the guidelines have already been used to inform the SEA of Surrey County Council's Minerals Local Plan. The revisions to the Framework, which took into account the findings from the evaluation, ensured that it was rigorous.

13.4 How cumulative effects could be considered more effectively through the use of the CEA framework

The CEA framework addresses cumulative impacts strategically and holistically, adopting a systems approach. The application of the Framework to the case studies

revealed weaknesses in those approaches and identified where the Framework could assist in improving cumulative effects considerations.

The Millennium Quarter CEA study was reactive since it was undertaken after project EIAs had been submitted and limited to assessing the cumulative impact from a few developments in the area. Although transport impacts were addressed at the planning stage, this was not carried through all the issues of concern. Application of the Framework would have meant dealing with all the potential impacts during plan preparation, avoiding delay and possibly a court case. This case illustrated the limitations of addressing cumulative effects mainly through planning conditions or obligations.

The 'development control' approaches used in two other cases were also reactive. Although a framework for the development of Creekside was prepared by the LPAs, the assessment of cumulative impacts was dealt with during the development control process. However, the lack of commonly agreed criteria in determining significance of cumulative effects between the LPAs resulted in disparate opinions on proposals. Application of the Framework during the strategy preparation would have determined significance criteria. In the case of Ebbsfleet, although cumulative effects issues were recognised during plan preparation, the impacts were addressed at the project level and so there was uneven treatment of impacts by EIAs. Also, the sustainability appraisals of relevant development plans did not consider cumulative effects and there was no input from the EIAs to strategic planning. The TEFRM Plan, incorporated SEA into the planning process but CEAp is undertaken in the later stages and the impacts appraised against objectives. Using the Framework would have ensured that appropriate baseline studies would have been undertaken during the early stages and that the effects assessed against a baseline. The main areas where the Framework would have strengthened these cases were:

- Providing guiding principles for cumulative effects considerations in relation to the plan;
- Consideration of cumulative effects early in the process;
- Consideration of all relevant plans and actions;
- Consideration of all potential impacts and impact relationships;
- Potential cumulative effects and their attributes better defined;
- Criteria for determining significance well defined and acceptable to parties;

- A holistic and systematic approach to considering cumulative effects;
- Involvement of stakeholders in addressing cumulative effects;
- Area-wide mitigation and monitoring proposals;
- Consideration of small impacts not covered by EIAs but that could be significant;
- Findings from the CEA have potential to contribute to strategic planning.

In addition, the Framework can ensure that an appropriate baseline is established to make the assessment meaningful. In developing the framework, there were some issues that needed to be addressed to ensure its effectiveness and these are discussed in the following sections.

13.5 CEA, SEA and sustainability appraisals

The final framework incorporates CEA into the SEA and plan making process. It takes into account the requirements of the SEA Directive and planning practice and is therefore relevant and appropriate. The SEA guidance for England indicates how an SEA can form part of sustainability appraisals and has made references to sustainability appraisal in parts of the guidance (ODPM, 2003). Under the Planning and Compulsory Purchase Act, sustainability appraisals will be mandatory for Local Development Documents and Regional Spatial Strategies. It is the Government's intention *"to define the future requirements for sustainability appraisals so as to make clear that in carrying them out, they must fully meet the requirements of the SEA Directive"* (Ibid, 2003, p.9). Guidance on sustainability appraisals will be issued by ODPM when the new planning system is implemented which should provide further details on the relationship between SEA and sustainability appraisals (Ibid, 2003). Existing sustainability appraisal procedures may be modified to incorporate the requirements of the SEA Directive, such as the provision of baseline information and requirements for consultations (Smith and Sheate, 2001).

As discussed in Chapter 7, there are fundamental differences in approach between SEA and sustainability appraisals. The SEA Directive emphasises a 'baseline-led approach' in which the alternatives are assessed against an actual baseline, the DETR guide to sustainability appraisal is based on an objectives-led approach' in which the options are appraised against objectives for sustainable development (Ibid, 2001).

The final framework integrates CEA within an SEA process as set out in the SEA Directive, which required that the baseline condition of the affected environment should be established. For CEA, establishing the baseline for selected resources and trends is integral to assessing cumulative effects. In order that CEA can be undertaken as part of sustainability appraisal, then that process has to be modified in terms of providing a baseline and approach in assessing potential impacts. This means establishing a baseline as proposed in the SEA Directive and as for CEA, baseline and trends for valued resources. It also means assessing the cumulative effects against that baseline. While sustainability appraisals usually appraise policies against objectives, this does not allow cumulative effects to be assessed. Objectives can have a role in CEA in terms of describing an ideal state for the valued resource or identifying enhancement measures but they cannot be used on their own to assess cumulative effects.

For the above reasons, the final framework addressed cumulative effects within an SEA. It focused on environmental effects and considered social or economic effects as a consequence of environmental impacts. This is in line with the SEA Directive, which focused on environmental aspects. There are, however, other forms of SEA that tend to include social and economic impacts in a greater degree[1].

However, if sustainability appraisal is be made mandatory in the UK and SEA is to be part of sustainability appraisal, then CEA can be undertaken assuming that the requirements of the SEA Directive are followed and that baseline for the valued resources are established. If sustainability is to be the overarching tool, then the cumulative effects of the other aspects (social and economic) should also be considered, so that the appraisal is not unbalanced. There are examples where social and economic cumulative effects have been considered (Braid et al, 1985; Tollefson and Wipond, 1998). Although these studies were not undertaken within the context of SEA or sustainability appraisal, they illustrate that consideration of cumulative effects can be extended to cover such issues. However, the assessment of cumulative social and economic impacts should also involve the consideration of the environmental impacts as a result of those effects.

[1] More comprehensive forms of SEA, as a tool for analysis that contribute a sustainability component to existing decision making processes and as an approach to decision making at the strategic level have been defined (Partidario and Clarke, 2000; Stinchcombe and Gibson, 2001).

There are those who argue that if economic, social and environmental factors are fully integrated within a single appraisal, such as sustainability appraisal, there is a risk that the environment can be overlooked (van der Vorst et al, 1999). If so, then there is a greater chance that cumulative effects, already overlooked in most assessments, may not be considered. This could, over time, undermine sustainable development objectives. It is therefore important that cumulative effects considerations should be incorporated within each stage of the SEA, as the proposed framework has indicated.

13.6 CEA boundaries

The SEA guidance states that *"sufficient data about the current and likely future state of the environment should be collected to allow the plan's effects to be adequately predicted"* (ODPM, 2003, p.17). This suggests the environment of the plan area, whereas for CEA, boundaries could extend beyond the local authority administrative boundaries. For example, air pollution could cover a wider area than the plan area. Successful assessment of cumulative effects must deal with the fact that while environmental response to impact is integrated, the institutional responsibility for controlling activities that impact the environment is often fragmented (CEARC and USNRC, 1986). This mismatch has been identified as an important cause of the difficulty in managing cumulative effects. Irwin and Rhodes (1992) argued that there is a mismatch between time and space scales of boundaries of decisions and boundaries of cumulative impacts. They suggested that to improve the ability to deal with cumulative effects there is a need to examine the mismatch between the scales of management and of impacts.

In terms of the SEA, which is undertaken for the plan area, the scale for assessing cumulative effects needs some careful thought so that appropriate boundaries are used. This is in line with the SEA guidance, which states: *"a more thorough assessment of secondary, cumulative and synergistic effects would involve additions to the main SEA or sustainability process"* (ODPM, 2003, p. 44). Boundaries relating to the valued resource could cover more than one planning authority area (e.g. park, marshes, creek). In assessing the cumulative effects of the resource, the baseline should cover the whole of the resource and not just the part within the local authority area. In applying the CEA framework, case studies were chosen at different planning scales: development of an area within one local authority (Millennium Quarter), development of areas covering two local authorities (Creekside and Ebbsfleet) and a sub region (Thames Estuary Flood

Risk Management Plan) (See Chapter 10). These cases demonstrated the different boundaries required for certain effects and that for some (e.g. transport and ecological impacts) there was a need for inter-agency co-operation. The case study application therefore reinforced one of the guiding principles in the CEA framework, which specified stakeholder involvement and partnerships in addressing cumulative effects.

13.7 CEA methods and network analysis

Sustainability appraisals use matrices in comparing options against objectives. Both the SEA guidance for England (ODPM, 2003) and Scotland (Scottish Executive, 2003) suggested the use of matrices for assessing the impacts of proposals against the key environmental resources. Although matrices can be useful in comparing elements, it cannot trace secondary or higher order impacts and so its use in CEA is limited to listing proposals and valued resources to see if there is a potential for impact.

Network analysis is a more useful method for analysing cause and effect. It is particularly useful in directing the assessment and the baseline collection by identifying impact pathways that need further investigation. The need for identifying cause and effect is recognised by the ODPM guidance (2003), which recommends the use of network analysis for identifying secondary, cumulative and synergistic effects.

13.8 Cumulative effects of urban regeneration

Actual cumulative effects from urban regeneration were identified in the case studies. Most related to space crowding and time crowding. Cumulative effects can result from many large developments implemented concurrently or sequentially within a limited area, such as in the Millennium Quarter. In this case study, construction impacts, normally regarded as short term, can become long term because the regeneration programme has a long implementation period where large projects take many years to construct. Urban related cumulative impacts have been identified in the case studies: increase in road traffic, air pollution and increase in demand for public transport.

The main cumulative impacts of urban regeneration on transport are those on public transport rather those from private vehicles. This is particularly so in London, where LPAs such as Greenwich, Lewisham and Tower Hamlets actively discourage the use of cars through policies such as limited parking spaces to reduce road congestion and air pollution. Furthermore, the use of public transport and other modes of travel are

promoted through provision of bus lanes, cycle lanes and pedestrian walkways. In terms of geographical extent of transport impacts, these were expressed beyond the LPA boundaries and to address these issues, LPAs have involved other LPAs and public transport providers (e.g. in Millennium Quarter and Ebbsfleet).

Addressing cumulative ecological impacts is particularly important in built up areas such as Creekside, where valuable ecological resources are adjacent to or on brownfield sites. The London Plan identifies Thames Gateway as the main brownfield development and growth area. One of the government's sustainability indicators is the proportion of brownfield land built on instead of greenfield land. In Creekside, all wildlife habitats are on brownfield land. Like many biologically rich brownfields in the Thames Gateway, they support populations of nationally rare species (e.g. black redstart). These habitats are therefore under development pressure from the regeneration of the Thames Gateway.

The Thames Gateway has been designated one of the four growth areas in the Sustainable Communities Plan (ODPM, 2003), which sets out plans to build additional 200,000 homes in these areas in the Southeast. In July 2003, plans for the first urban development corporations in the Thames Gateway were outlined, focusing on east London and Thurrock. More recently, £63 million was announced for environmental and infrastructure projects in the Southeast, including the Thames Gateway. However, concerns over these proposals ranged from the lack of education, health and transport facilities to support these housing developments (Willis and Marrs, 2004). This research highlights the severe environmental capacity constraints of the area and a range of potential cumulative effects: transport, air pollution, waste and water resources. The South East is the driest region in the country and the large numbers of developments are likely to affect water supplies (Environment Agency, 2002). At the other end of the scale, most of Thames Gateway is in the floodplain and so these incremental developments are likely to contribute to flood risk.

Increase in flood risk is a cumulative effect of climate change, sea level rise and ageing flood defences. Continuing sea level rise due to natural geological processes exacerbated by the effects of climate change and exogenous environmental changes that contribute to flood risk need to be taken into account in CEA. Inappropriate urban regeneration developments in the floodplain, such as those proposed in the Thames

Gateway are also likely to contribute to the problem. The secondary and higher order effects of flooding were explored in Chapter 10. These impacts included loss of habitats, damage to buildings and infrastructure, health impacts and economic and social effects. The scale of the problem is regional in scope covering areas along the Thames Estuary and parts of the Thames Gateway.

This research identified cumulative impacts that were expressed at different scales, indicating what boundaries might be used in assessing cumulative effects. Noise impacts and to a certain extent, transport impacts on local roads can be addressed within a local planning authority, such as the Millennium Quarter in Tower Hamlets. On the other hand, transport and ecological impacts extended beyond a local planning authority's boundary, as in the cases of Creekside and Ebbsfleet. Thus, a strategic and partnership approach by the local authorities concerned was needed to assess such effects. At a larger scale, the cumulative impact of flooding is one issue that needs to be addressed at a regional or watershed level, as shown in the TEFRM Plan.

There are certain factors that contribute to cumulative effects: multiple, concurrent developments, impacts that interact either additionally or synergistically, and when these impacts affect the same receptors. These cases revealed that if not addressed strategically, significant cumulative impacts could result from urban regeneration plans and programmes.

Apart from representing different areas in the Thames Gateway, the case studies represented different approaches for addressing cumulative effects expressed in various geographical scales. The cases also demonstrated that assessments of some impacts, such as transport are more developed and undertaken on a wider geographical scale than other impacts. Although the planning authorities in the case studies used a variety of tools to address cumulative impacts such as planning frameworks, capacity studies, supplementary planning guidance and planning conditions, none were as comprehensive, strategic and systematic in addressing cumulative effects as the proposed Framework. In relation to urban regeneration, it is crucially important to develop holistic approaches (Greenhalgh and Shaw, 2003). Before final conclusions are drawn, the effectiveness of the methodology used in this research and the reliability of the conclusions, which follow from the research are discussed.

13.9 Critique of the research methodology

This study has been based upon reviews of EISs and plan appraisals to establish current CEA practice, followed by consultations with experts, planners and practitioners to investigate how CEA might fit within strategic planning and plan appraisals. In addition, cumulative effects in urban regeneration were explored in the context of the Thames Gateway. The findings from those research activities informed the draft framework. The testing of the framework involved a questionnaire evaluation by experts and potential users and the selection of case studies and review of all relevant documentation followed by interviews and contacts with various stakeholders (planners, consultants, consultees, local group representatives, etc) in the planning process.

The review of EISs was carried out in a methodological and rigorous manner, but there were some limitations associated with the selection of EISs for review. EISs considered for the review were limited to those that were held in places to which the researcher had access. So the sample was selected from EISs available at the DTLR library and at Imperial College between March and July 2000. Nevertheless, a total of 50 EISs were reviewed from various project types and locations. In undertaking the review, all supporting documents were examined but not all EISs produced the same documentation and so it was necessary to base the review on the available documents and assume that this documentation presented the whole picture of the process.

In terms of the review of environmental/sustainability appraisal, a rigorous method was employed but the sample was limited to those available at that time (between Spring 2001 and Summer 2002) in the Thames Gateway. Although this sample is not nationally representative, it helped establish the focused context for the research project.

In relation to the first interview survey (28 interviews), it would have been helpful to have undertaken a greater number of interviews and therefore have a larger sample, but there were several experts and practitioners who could not spare the time to be interviewed. Nevertheless, interviews were conducted with the key stakeholders, i.e. those from the ODPM, planning authorities, the Environment Agency, environmental organisations, academia and consultants, which provided valuable input into the research.

In relation to the application of the draft framework on case studies, ideally it would have been useful if the Framework were tested on actual SEAs of plans. However, as the review of environmental/sustainable appraisals revealed, appraisals generally do not consider cumulative effects. Applying the draft framework on case studies by comparing actual planning situations and approaches for dealing with cumulative effects against the proposed Framework, however, demonstrated how the CEA framework fitted within planning and how it could improve those cases. Moreover, the case studies provided rich, detailed data on cumulative effects issues and together with comments and suggestions from the case study interviews, allowed the testing of the network analysis method.

With regard to the evaluation questionnaire, many of the sections were left blank so the respondents could put their comments. More detailed questions could have been asked on certain elements but it might have been restricting, with comments limited to answering those questions. Thus, many detailed and helpful comments were received from the ODPM, the Environment Agency, an independent consultant and planning officers.

13.10 Summary

This Chapter discussed the preparation and evaluation of the Framework, its potential contribution to planning and the issues that needed to be addressed in its development. The next chapter presents the conclusions and recommendations.

Chapter 14 Conclusions and Recommendations

14.1 Introduction

Cumulative effects assessment (CEA) is a systematic procedure for identifying and evaluating the significance of effects from multiple activities. So far, CEA has been undertaken mainly at project level but as experience in EIA has grown, limitations in addressing cumulative effects in project EIAs have become apparent. Consideration of the literature suggested that these effects are better addressed at strategic level by incorporating CEA into land use planning or SEA. SEA has been promoted as an appropriate tool for addressing cumulative effects. The Directive 2001/42/EC *on the assessment of the effects of certain plans and programmes on the environment* (the 'SEA Directive') requires that cumulative effects should be considered when assessing likely effects on the environment. This legislation therefore provides an opportunity to address cumulative effects at strategic level. This thesis explores how CEA can be integrated into the SEA and planning process in the UK, taking into account the requirements of the SEA Directive. It proposes a framework for integrating CEA into SEA.

The CEA Framework proposed by this research makes an important and original contribution to the field of CEA. At present, there is no detailed guidance on how cumulative effects can be considered in SEA of plans in the UK. The Framework provides detailed guidelines for considering cumulative effects at each stage of the SEA and planning processes and can therefore strengthen SEA. It addresses cumulative effects strategically and systematically and guides participants during each stage of the SEA and planning processes. Planners and practitioners can use the Framework to consider cumulative effects in preparing SEAs to ensure that the requirements of the SEA Directive in relation to cumulative effects are met. The Framework can also be used by consultees in commenting on cumulative effects issues and decision-makers to check whether cumulative effects have been considered sufficiently in the SEA process. The Framework includes a Quality Assurance Checklist which could be used to examine how effectively the SEA has considered cumulative effects. Use of the Checklist can highlight where cumulative effects issues have not been effectively addressed and identify where further work may be required.

This research focused on cumulative effects on urban areas where there have been few studies since most CEA research have focused on wetlands, parks or natural areas. By

focusing on urban regeneration in particular, this research contributes to this field where traditionally, research has been mainly concerned with social and economic aspects. Furthermore, in exploring cumulative effects in urban regeneration, effects were defined in terms of their nature and extent and the factors that are likely to contribute to them. The analysis of existing planning approaches for dealing with them has identified areas where planning practice could be improved. These findings therefore provide useful information to planners and policy makers.

Finally, this research makes an important contribution to the debates surrounding the regeneration of Thames Gateway by highlighting the cumulative effects issues that need to be addressed in planning for sustainable urban regeneration. Based on the findings of the research, several major conclusions were reached and from these, some key recommendations are made for future action.

14.2 Conclusions

The research arrived at five main conclusions. Firstly, cumulative effects are rarely considered at project and strategic levels. An important finding is the various concepts of cumulative effects, which points to the need for clarification in policy and legislation. Although some EISs and environmental/sustainability appraisals mentioned cumulative effects, the consideration of cumulative effects was generally poor. Several reasons were identified for this poor attention to cumulative effects and among them is the lack of understanding of the concept, appropriate framework and guidance. The limitations of EIAs in addressing cumulative effects indicated a need for a framework for considering cumulative effects at strategic level. For that to happen a Framework consisting of a procedure and guidelines need to be produced.

Secondly, this research has identified a number of weaknesses in approaches to address cumulative effects: reactive and implemented too late in the process; inappropriate spatial and temporal boundaries used; inadequate baseline for selected resources; limited/absence of mitigation or monitoring proposals and inappropriate methods. In addition, some of these approaches were not integrated into the plan-making process and did not follow a systematic procedure. Some cumulative effects, such as transport impacts (where there are existing data and modelling techniques are more developed), were better considered than others so that assessments were not comprehensive.

Thirdly, the majority of those interviewed favoured incorporating CEA into SEA or sustainability appraisals rather than introducing a new process, with most of those preferring the SEA process. However, when the new planning system is enforced, sustainability appraisals will be mandatory. There are indications that the requirements of the SEA Directive will be incorporated into the sustainability appraisal procedure (ODPM. 2003). To properly address cumulative effects and fulfil the requirements of the SEA Directive in relation to cumulative effects, that procedure needs to be modified significantly in terms of establishing a baseline for selected resources and assessing effects against that baseline.

Fourthly, the research has shown the important role of partnerships among planning authorities and stakeholders in addressing cumulative effects. This was demonstrated in two case studies, in Creekside, the local environmental groups took a central role in addressing cumulative ecological effects in their area. The SEA Directive provides opportunities for consultations. Recently, consultation and participation have been given more emphasis in planning activities. Consultations are required in the preparation of a community strategy,[1] to which a local authority should have regard in preparing plans. This highlights the importance of active participation and the need to be more proactive than the Directive itself appears to require, such as the involvement of more stakeholders (representatives from NGOs and local environmental groups) in scoping.

Fifthly, a main consideration in developing the framework was choosing an appropriate method for identifying impacts in scoping and in analysing effects. Tools used in CEA, SEA and planning were examined in order to find a method that would be workable to planners in identifying impacts and impact relationships that lead to cumulative effects. To be practicable, such a method should be able to use available data and examine cause-effect relationships. The network analysis method was chosen to help facilitate conceptualisation of cumulative effects. This method was tested in the case studies and the feedback from the case study interviews were used to further refine the diagrams. Its value lies in that planners and lay people alike can readily understand it. It is a useful method for identifying what aspects needed further investigation that can be carried out through other methods such as trends analysis and capacity studies.

[1] Every local authority are required to prepare a community strategy for promoting or improving the economic, social and environmental well being of their area under the Local Government Act 2000.

Network analysis, as employed in the research, has shown that it has more potential than previously exploited. It identified pathways and impact relationships that were significant and not obvious and it was useful in identifying mitigation. It can show both positive and negative impacts which is useful for decision-makers in identifying the consequences of a strategy or option. Also, the method can be extended to show social and economic impacts from environmental impacts.

Although network analysis has been around for a while, its application in CEA has been largely untested (Canter, 1999) and limited. It has been suggested that network analyses that identified all possible direct and indirect configurations of effect, especially from multiple sources, quickly become complicated (Sadler and Verheem, 1996). However, as used in this research, network analysis can be as simple and as complex as the assessor requires. It can be broken down into smaller diagrams analysing specific issues (transport or ecological impacts) or it can present a picture of overall impacts. The difficulties may lie not in the method itself but because the concept of cumulative effects is poorly understood. As demonstrated in this thesis, it is easy enough to use if one understands the purpose of using it (i.e., identify potential cumulative effects and impact relationships). Thus, it is time for the network analysis method to be reinvigorated as a methodology for CEA that is practical, feasible and useful.

14.3 Recommendations

From these conclusions, some recommendations relating to public policy and to the improvement of CEA practice were identified.

14.3.1 Policy recommendations

The further development of CEA will depend on government policies and these recommendations are aimed at policy makers and local government bodies.

- Policy makers should ensure that CEA is integrated into SEA, sustainability appraisals and plan-making processes. CEA should be an essential feature of the appraisal guidance to be produced by the ODPM for the new planning system. Thus, the guidance should include establishing the baseline and trends for valued resources, evaluating potential cumulative effects and proposing mitigation measures and monitoring of these effects.

- Policy makers and planners formulating regeneration strategies, plans and programmes should evaluate the potential cumulative environmental effects of those plans and programmes. Traditionally focused on economic objectives, urban regeneration objectives should be redefined so that the environment is equally considered.

- A strategic CEA in a SEA of these Plans should be a priority for the Thames Gateway Strategic Executive at the ODPM before the 'zones of change' are developed further. The CEA should address the severe environmental capacity constraints in the Thames Gateway and the adverse cumulative environmental impacts of development proposals under the Thames Gateway Planning Framework and the Sustainable Communities Plan.

- Policy makers should re-consider brownfield policy. Some brownfield sites, particularly in urban areas, have ecological and/or societal value and the potential effect of their cumulative loss on urban resources should be fully considered when deciding their future use.

14.3.2 Recommendations to improve CEA practice

- CEA should be integrated into the SEA and plan preparation processes so that cumulative effects are taken into account in plan making.

- Local stakeholders can make a valuable contribution to CEA and should have a more proactive role in scoping than the SEA Directive requires.

- The concept of cumulative effects and the role of CEA should be clarified in regulations and government guidance on SEA and sustainability appraisals.

- Training programmes for planners and other participants in the planning process should include cumulative effects aspects. There have already been some court cases[2] involving cumulative effects. With the implementation of the SEA Directive, cumulative effects issues could be an area of contention.

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[2] For example, the case of Weston Homes and Tower Hamlets (see Chapter 10) and the 'Effra' site in Vauxhall, London (appeal by Dovey Investments Holding against London Borough of Lambeth and Wandsworth, 1995.

14.4 Further Research

There are several topics identified in the course of the research, which could be further investigated. Some of these involve elements in the process while others refer to the wider applicability of CEA.

Scoping and public participation

There is a need to investigate the role of local organisations in CEA. Public participation in CEA is an area not well researched and ways that the public can participate need to be explored.

Impact linkages and methods for analysis

The network analysis method applied in this research identified impact pathways, which could lead to cumulative effects. Further research could extend the method using computer-based modelling, such as STELLA[3]. Further research that could complement the network analysis method by providing a spatial dimension is the application of GIS in CEA of plans. Further work is also required in determining relative contributions of different stresses on valued resources.

Significance

Further research is required in determining significance in strategic CEA because of the large area and long time period involved. The usefulness of qualitative measures, such as social or environmental acceptability should be investigated.

Mitigation

Further research is needed on mitigation measures at strategic levels. Research on how effective specific policies have been in addressing cumulative effects could look at particular cases.

Monitoring

Further research could define environmental indicators, which would be useful for monitoring the cumulative effects of plans.

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[3] Richmond et al (1987).

Institutional roles

The relevant planning authority, with the participation of stakeholders, should undertake strategic CEA. Therefore, there is a need for research into the roles and potential contribution of agencies and organisations involved.

Sectoral CEA

This research project focused on cumulative effects in urban regeneration. Further studies can focus on cumulative effects in other sectors or programmes, such as transport, housing or water resources, although there is still considerable scope in urban regeneration.

Cumulative Social and Economic Effects Assessments

This thesis addressed environmental cumulative effects and any consequent social and economic effects within an SEA. If SEA will form a part of Sustainability Appraisal (ODPM, 2003), then there is a need for research into cumulative social and economic effects of plans and programmes if the appraisal is to provide a balanced or comprehensive approach.

14.5 Summary

This research has highlighted the value of a CEA approach at strategic level. The importance of assessing cumulative effects is acknowledged by the EU SEA Directive, which required that cumulative effects be considered in the assessment of plans. This research has shown how CEA can assist in decision-making. Integrating CEA earlier in the planning process can improve understanding of the wider implications of cumulative effects, facilitate choosing alternatives which are less likely to contribute to significant effects and examine more comprehensive and effective mitigation measures. Considering cumulative effects at strategic level can improve the planning process by providing an overall perspective of cumulative effects issues so that large developments can be seen in their proper context and minor developments are not overlooked. Finally, the CEA Framework proposed in this thesis has the potential to address cumulative effects problems and make a positive contribution to SEA of plans in meeting the requirements of the Directive and strengthening environmental planning.

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Appendix 1. Environmental impact statements reviewed

No	Environmental Statement	Location	Region	Project Type	Year submitted
1	South Lowestoft Relief Road	Suffolk	Eastern	Road	1999
2	Birmington-Staveley By-pass	Derbyshire	East Midlands	Road	1995, 1998
3	A 142 Fordham By-pass	Cambridge	Eastern	Road	2000
4	Immingham Combined Heat and Power Plant	North Lincolnshire	East Midlands	Power station	Nov 2000
5	Thameside Energy Park CHP Plant & Energy Distribution System	Purfleet, Essex	Eastern	Power station	Feb 2000
6	Natural Gas Pipeline to Thames Energy Park	Purfleet, Essex	Eastern	Gas pipeline	Dec 1999
7	Ridham Dock Integrated Waste Management Facility	Swale	South East	Waste to energy	May 1999
8	Belvedere Refuse to Energy Project	Belvedere, Bexley	London	Waste to energy	April 1991
9	Kingsnorth Integrated Waste Management Facility	Rochester, Kent	South East	Waste to energy	Oct 1996
10	Kingsnorth Integrated Waste Management Facility Residue Disposal Site*	Rochester, Kent	South East	Landfill site	Oct 1996
11	Norton Marsh: Proposed Extension to Arpley Landfill	Warrington, Cheshire	North West	Landfill site	Oct 2000
12	Flood Defences Improvement	Southend on Sea	Eastern	Flood defence	2000
13	Isle of Grain proposed drainage	Rochester, Kent	South East	Land drainage	Dec 2000
14	Westhay Heath Peat Extraction	Somerset	South West	Peat extraction	July 2000
15	Potton Pool Quarry	Cannock Chase, Staffordshire	West Midlands	Sand and gravel quarry	July 2000
16	Woodhead Open Cast Coal Extraction	Barnsley, Yorkshire	Yorkshire & Humberside	mining	June 2000
17	Stonecastle Farm Quarry	Tonbridge, Kent	South East	Quarry extension	May 2000
18	Medway Cement Works	Medway, Kent	South East	Cement works	1997
19	Havering Riverside	Havering	London	Commercial/industrial	1997
20	Multiplex Cinema, Health & Fitness Centre & Food Outlet	Barnstaple, Devon	South West	Mixed use devt	Aug 2000
21	Park Royal Southern Gateway	Acton, Ealing	London	Mixed use devt	Feb 2000
22	East Manchester District Centre	East Manchester	North West	Mixed use devt	Aug 2000
23	Chavasse Park	Liverpool	North West	Mixed use devt	Aug 2000
24	Rochdale	Greater Manchester	North West	Mixed use devt	Sept 2000
25	Broomsgrove	Hastings	South East	Mixed use devt	Dec 2000
26	Redevelopment of Taylor Woodrow site	Ealing & Hillingdon Middlesex	Eastern	Mixed use devt	Aug 2000
27	Earlsgate	Swindon	South West	Res/commercial	Nov 1999

28	Woodville Woodlands	Leicester	East Midlands	Residential	Dec 2000
29	The Swale Gateway Development	Isle of Sheppey, Kent	South East	Industrial/ commercial & residential schemes	Feb 1994
30	Stockmoor Village	Bridgwater, Somerset	South West	Residential	Nov 2000
31	Willstock New Village	Bridgwater, Somerset	South West	Residential	May 2000
32	Kings Cross Railways Bill No. 1 & 2	Camden	London	Railway terminal improvements	May 1991
33	Jubilee Line Extension	Central to East London	London	Railway underground	March 1990
34	Channel Tunnel Rail Link	London, Essex, Kent	London & South East	Rail link	1994
35	M2 - Junctions 1-4 widening	Kent	South East	Motorway widening	Nov 1994
36	Ebbsfleet Development	Gravesham & Dartford, Kent	South East	Station & mixed use devt	Dec 1995
37	South Thameside Development Route	Gravesham & Dartford, Kent	South East	road	Oct 1995
38	London City Airport	Newham	London	runway extension	Dec 1989
39	Terminal 5- Heathrow Airport	Hillindon, Spelthorne & Hounslow	London	New terminal	1993
40	Heathrow Express Extension	Hillingdon	London	Underground railway	Sept 1994
41	Manchester Airport 2nd Runway	Manchester	South West	New runway	1993
42	Gravesend Wastewater Treatment Works	Gravesend, Kent	South East	Wastewater treatment plant improvements	Dec 1996
43	Motney Hill Wastewater Treatment Works	Medway, Gillingham	South East	Wastewater treatment plant improvements	Sept 1996
44	Wharrels Hill Wind Farm	Cumbria	North	Wind farm	Dec 2000
45	Somerton wind turbine	Great Yarmouth	Eastern	Wind turbine	1998
46	Testwood Lakes	Hampshire	South West	Reservoir & mineral extraction	July 1991
47	Otterburn Training Area	Northumberland	North	Army field training centre	April 1995
48	Trinity III Terminal (Phase 2) Extension	Port of Felixtowe, Suffolk	Eastern	Port extension: new quay	Oct 2000
49	Proposed New Quays at Former Power Station Site	Cliff Quay, Ipswich	Eastern	New quay	Sept. 2000
50	South Ipswich Brownfield Regeneration & Improved Access to Port	Ipswich	Eastern	Mixed use & link road	Dec 2000

Appendix 2: Environmental impact statement review criteria
Consideration of Cumulative Effects

ES number:
Project Name:
Location:
Planning Authority:
Date submitted:
Lead Author:
Proponent:
Volumes/supplementary information:
Outcome:
Project Type:
Brief Description: -size -timescale/duration -schedule of construction/ operation/decommission -associated developments

Concept of cumulative effects and documentation	✓/ x	Comments
1. Are cumulative effects listed in the table of contents, non-technical summary or introduction?		
2. Is the concept of cumulative effects (CEs) addressed in the ES directly?		
3. Is the concept of CEs addressed indirectly?		
4. Is there a definition of cumulative effects?		
5. Is there a separate section for the assessment of cumulative impacts?		
Scoping		
6. Are valued environmental components identified?		
7. Are other activities that may affect VECs identified?		
8. Are spatial and temporal boundaries identified? How were these determined and why are these considered appropriate?		
9. Are cumulative effects considered in scoping?		

10. What are the main cumulative effects issues attributed to the project?		
11. What are the main cumulative effects issues attributed to other projects and activities in the region?		
Baseline Conditions and Identifying Relevant Activities		
12. Are land uses and developments in the surrounding area or region described?		
13. Are policies, plans and resource management initiatives pertinent to the project identified?		
14. Are past, present and future activities/projects that may interact with the effects associated with the project identified and described adequately?		
15. Was the process to identify relevant future activities described? What rationale and assumptions were used?		

Identification, Prediction and Evaluation of Effects		
16. Are CEs addressed alongside direct and indirect effects?		
17. Are CEs discussed separately for each of the environmental resources/components to be affected by the project?		
-community resources		
-ecology and nature conservation		
-geology, minerals and soils		
-hydrology and water resources		
-air quality		
-transport		
-noise		
-landscape and visual amenity		
-agricultural land		
-archaeology and cultural heritage		
-disturbed and contaminated land		
18. Are CEs of the project assessed considering the effects from other existing or proposed projects?		

19. Is the relative contribution of the project to the existing environmental conditions indicated?		
20. Are the cumulative effects of the project on selected indicators described?		
21. Are uncertainty and risk dealt with?		
22. Are transboundary/global issues addressed?		
Methods		
23. Are guidelines/methodologies used in the CEA process described? - methods for identifying CEs - methods for predicting CEs		
24. Are CEs qualitatively described?		
25. Are CEs quantitatively described?		
Mitigation		
26. Are mitigation measures or specific management objectives proposed to address the project's cumulative effects?		
27. Is the effectiveness of mitigation indicated?		
Evaluation of Significance		
28. Are there any residual impacts remaining after mitigation? What are the magnitude, duration and significance of these Impacts?		

29. What are the criteria used to determine significance?		
30. What is the relationship of the effects with existing thresholds and selected indicators?		
Monitoring		
31. Are there any proposals for monitoring adverse outcomes?		
32. How will feedback from monitoring be incorporated into the long-term project operations? What reporting mechanisms are proposed?		
Management of Effects		
33. Are there specific government and/or company goals and management objectives proposed to address the project's cumulative effects?		
Conclusions		

Appendix 3. Environmental/Sustainability Appraisals Reviewed

1. Kent County Council and Medway Council Structure Plan: Interim Sustainability Appraisal (SA) (2002). [Updated 2003 – Working paper No.15- Sustainability Appraisal].
2. Essex County Council Environmental Appraisal (EA) of the Draft Deposit Plan (1998).
3. London Borough (LB) of Redbridge EA of the Unitary Development Plan (UDP) (1997).
4. LB of Newham UDP EA (1996).
5. LB of Bexley UDP EA (2000).
6. Gravesham Borough Local Plan 2nd Review Strategic Appraisal (SA) (2000).
7. LB of Lewisham UDP EA (2000). [Part of consultations exercise on deposit draft of UDP].
8. Dartford Borough Local Plan Review SA (2000). [Deposit Draft]
9. Swale Borough Local Plan SEA (1996).
10. LB of Greenwich UDP SA (2002). [First Draft UDP].
11. LB of Barking and Dagenham UDP SA (Sept.1999). Prepared by the Thames Gateway Strategy Team
12. Basildon District Local Plan EA (1998). (Plan adopted 1998).
13. LB of Tower Hamlets UDP EA (2002). (First stage of review process- current UDP adopted 1998).
14. Draft London Plan SA (2002). Prepared by Entec.
15. Draft RPG 9 for the South East SA (2000). Prepared by Baker Associates. [SA appraisal of proposed changes to draft RPG 9].

Appendix 4: Environmental/sustainability appraisal review criteria
Cumulative effects considerations

Date reviewed:
Environmental/ Appraisal (type):
Appraisal title:
Planning authority:
Type of plan (UDP/Local devt plan/RPG):
Date completed:
Prepared by:

Comments:

Review category	Review Criteria	✓/x	Comments
1. **Cumulative effects considerations**	Are cumulative effects mentioned in the environmental appraisal?		
2. **Description of:** **the Plan**	Are related land use plans (neighbouring Local Authority plans, regional plan) and sectoral plans considered?		
the affected environment	Is the wider environment (regional) affected by the activities arising from the plan defined?		
the baseline conditions	Is the present state of the environment (quality of air, water and land resources) analysed? In establishing environmental stock, are key assets (VECs) identified? Is the current status of these VECs defined? Are past, present and future activities that have an effect on (VECs) identified?		

3. Identification and Evaluation of Key Impacts Scoping Environmental or sustainability indicators Cumulative effects Assessment of impact significance	Were cumulative effects considered in scoping? Were indicators formulated in order to assess the impact of the plan on the environment? Were potential cumulative impacts from the activities resulting from the plan identified and predicted? Are the criteria used for determining impact significance indicated? Is the significance of potential cumulative effects discussed?		
4. Alternatives, Mitigation and Monitoring Alternatives Mitigation measures Monitoring	Are cumulative effects taken into consideration in assessing alternatives with reference to policies and proposals of the plan? Are there any mitigation measures proposed for cumulative effects that may arise from the policies and proposals of the plan? Are there proposals for monitoring cumulative impacts arising from the policies and proposals of the plan?		
5. Communication of results	Are uncertainties and limitations with regard to the consideration of cumulative effects indicated?		

Appendix 5: Interview Survey: Example of letter and interview schedule to guide the interview

Dear

Considering cumulative effects in planning

I am a PhD student with the Environmental Policy and Management Group, Department of Science and Technology, Imperial College, London carrying out a research project on cumulative environmental effects assessment. The focus of my research is on the cumulative environmental effects of urban regeneration strategies in the Thames Gateway.

Aim of research

To develop a framework for the systematic consideration of cumulative effects at strategic level. The framework consists of a process and a method designed to incorporate the consideration of cumulative effects into the planning and decision making processes.

Cumulative Effects Considerations in the UK

Currently, project EIAs are required under the Environmental Impact Assessment regulations to consider cumulative effects. However, previous reviews of EIAs have found that cumulative effects are rarely considered. As the EIA/CEA literature suggest, there is a lack of guidance and appropriate methodologies for assessing cumulative effects in the UK. It has been recognised that project level EIAs are limited by the framework they operate in to deal with cumulative effects issues adequately. Some authors have suggested that a more appropriate context for considering cumulative effects issues may be the strategic level. For urban regeneration strategies, for example, this would be at the programme level or at an area wide level

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Consultation process

My research project includes a consultation element, which seeks views on:

- Cumulative effects
- Examples of cumulative effects issues
- Cumulative effects relating to urban regeneration strategies
- Approaches for incorporating consideration of cumulative effects into the plan making process
- Whether there should be a tiered system of assessing cumulative effects and what issues could be assessed at the different planning levels (e.g. project, local plan and regional plan levels)
- What features should be included in an assessment of cumulative effects
- Whether the network analysis method could be useful in the assessment and decision making and to what extent
- Whether the quality of life method could be useful in identifying valued environmental resources in the subject area and for determining impact significance

I would be grateful if you could spare time to let me interview you. I anticipate that the interview will take about an hour. I shall contact you shortly to see if you are happy to participate, and if so, to arrange an interview at your convenience.

Yours sincerely

Lourdes Cooper

Schedule of options

Options for assessing cumulative effects:

- **Cumulative Effects Assessment (CEA) integrated into sustainability appraisals of plans;**
- **CEA integrated into Strategic Environmental Assessment (SEA) of development plans;**
- **A CEA framework for the region or sub-region**
- **Strengthening CEA at project level by widening scope.**

Interview Schedule
Consultation questions

Concepts of cumulative effects and its assessment

There is a difference of opinion on the concept of cumulative environmental effects and its assessment. As part of the consultation process, I should like to ascertain current understanding of the concept of cumulative effects.

1. How would you define cumulative environmental effects? Please give examples of cumulative effects[1].

2. What types of cumulative effects issues can be addressed through the planning and EIA process?

3. To what extent can cumulative effects considerations assist in planning and decision-making?

Approaches for considering cumulative effects

4. Which of the five following options is the most feasible/desirable approach for improving the assessment of cumulative effects?

- CEA integrated into sustainability appraisals of plans;
- CEA integrated into SEA of development plans;
- CEA framework for the plan area;
- Strengthen CEA at the project level by widening scope.

5. What features should a cumulative effects assessment (CEA) approach have that would make it feasible both at the project and strategic levels?

6. Which cumulative effects issues can be addressed at different geographical scales (regional/sub regional/local)?

7. Should a tiered approach to CEA be appropriate and if so how would it work?

8. What level of information or criteria should be used to determine significance of cumulative effects at each decision making level?

9. What are the constraints in the introduction of a CEA approach into planning?

10. What approaches/methods do you use to incorporate cumulative effects considerations into decision making?

[1] For those with responsibility in the Thames Gateway, examples of cumulative effects and potential causes were sought.

Appendix 6: Case Studies

6.1 Case study Protocol

Box 1: Case studies aims and methods

Aims and activities:

1. To test the draft framework process:
- investigate approaches and process for addressing cumulative effects
- compare the case study approaches and processes to the proposed process in the framework
2. To test the network analysis method
- identify types of cumulative effects resulting from urban regeneration schemes in the area
- identify causes and factors that contribute to cumulative effects;
- identify pathways of impacts and impact relationships that could lead to cumulative effects
- to appraise the usefulness of the network analysis method for identifying and analysing cumulative effects.

Methods:

- Documentary analysis: EIAs, UDPs, local development plans, environmental/ sustainability appraisals, area development frameworks, master plans, committee reports, studies and reports.
- Semi-structured interviews: planners, EIA consultants, developers' agents and representatives from statutory and non statutory agencies, NGOs and local organisations.

6.2 Case study interview questions

A schedule of interview questions was used for the case studies as shown in Box 2. Since the interviewees consisted of participants with varying roles in the planning process, these questions served as a general guide. For planners, however, more specific questions relating to the planning process were asked for each case study as shown in Box 3.

Box 2: Examples of Interview questions

- What cumulative effects issues resulting from urban regeneration schemes have you identified in the case study area?
- How were these cumulative effects considered?
- To what extent were effects from developments considered in relation to other developments in the area? What was the time frame for considering effects?
- What methods were used in assessing these effects (e.g. capacity studies, quality of life capital, GIS)?
- What standards or thresholds did you use to determine the significance of those effects?
- How useful was the approach adopted? How did it contribute to strategic planning? To decision making?
- Were other agencies involved in the process?
- What were the constraints to assessing cumulative effects?

These questions were directed specifically to planning officers. In the example shown below, the questions related to the Ebbsfleet area. Similar questions were asked relating to the other case studies.

Box 3. Semi-structured Interview Survey Schedule (planners)

1. What cumulative effects issues arising from urban regeneration developments have you identified in the Ebbsfleet/Eastern Quarry Area?
2. Are there any cumulative effects from developments in the Ebbsfleet Valley that extend beyond Dartford Council's boundaries?
3. What arrangements do you have with Gravesham Council's Planning Department for dealing with cumulative impacts?
4. What approach do you use for considering cumulative effects from various developments (past, existing and proposed) in the area within the plan appraisal process? Do you use cumulative effects indicators?
5. For major developments, to what extent are these developments considered in relation to other developments in the area?
   - What is the time frame in considering impacts?
   - What is the geographical scope in considering impacts?
   - Are indirect, secondary and induced activities considered?
6. To what extent are minor activities (which may in themselves not have major impacts but when considered with other similar activities could result in cumulative impacts over time) considered in the planning and decision-making processes?
7. How useful would a cumulative impact study be to plan-making and decision-making?
8. Which issues do you think can be addressed at strategic level (through plan-making and sustainability appraisal/strategic environmental assessment processes)? How can cumulative effects considerations be integrated into the above processes?
9. What are the benefits in considering cumulative effects at strategic level (local plan-making process, sustainability appraisal/ SEA and sub-local plan preparations)?
10. What are the constraints in considering cumulative effects at strategic level?
11. Can you suggest how linkages can be established between strategic and development control processes in relation to cumulative effects?
12. Is there a role for the public in considering cumulative effects? If yes, what would that role be?
13. Would a network analysis method be useful in identifying and analysing cumulative effects (*Example will be shown)?*
14. Can you suggest any other application of the network analysis method?

6.3 Background and sources of information for each case study

Some background information on each case study is presented in this section. The Thames Gateway was discussed in Chapter 8 and so only the sources of information are presented here. The main sources of information for each case study included documents, which provided the background of issues, developments, policies and processes in the case studies. Information from these documents and the case study interviews were used to analyse case study approaches, processes and apply the network analysis method. Network diagrams were constructed based on information about the area and potential impacts from developments.

6.3.1 Thames Gateway

Box 4: Sources of Information for the Thames Gateway

DEFRA and ODPM (2004) *Creating sustainable communities: Greening the Gateway.* London: ODPM.
DETR (2001) *Thames Gateway Review: Final Report.* London: HMSO.
DOE (1995) *Regional Planning Guidance RPG 9a: Thames Gateway Planning Framework.* London: HMSO.
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Environment Agency (1998) *Thames Environment 21.*
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Marrs, C (2004) *The great growth riddle.* Regeneration and Renewal. 21 May 2004.
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Thomas, G. (editor) (2000) *Thames Gateway Development Guide.* London: Gateway Publishing and Events Ltd.
Thames Gateway London Partnership (2000). *Thames Gateway River Crossings. Time for Action.*
Thames Gateway London Partnership (2001). *Going East. Thames Gateway: the future of London and the South East.* The Economic Strategy of the Thames Gateway London Partnership
Thames Gateway London Partnership (2002) *Thames Gateway London: The Transport Agenda.*
Wardle, D. (2002) *The Thames Gateway Environment: Risks and Opportunities.* Paper presented at the Thames Gateway Strategic Partnership Environment sub-group meeting 13 March 2002.
Whittle, K. and Williams, P. (2001) *Thames Gateway- What does it mean for the Thames Estuary?* Talk of the Thames. London: Thames Estuary Partnership
Willis, B. and Marrs, C. (2004) *Concerns over Communities Plan.* Regeneration and Renewal. 30 January 2004.

6.3.2 Millennium Quarter Master Plan

The Isle of Dogs used to be a thriving industrial and port economy but by the late 1960's, the area had become one of the most deprived areas in Britain. However, since the Canary Wharf developments in the Docklands in the mid-1990s, the Isle of Dogs has seen an increase in employment and economic activities.

The Master Plan details the improvements that the Council identifies as necessary in order to realise the vision for the area. It also identifies that improvements will be provided from financial contributions and other obligations secured from developers through legal agreements when planning permission is granted, which is material to the determination of planning applications within the Millennium Quarter.

Review of EIAs within the Millennium Quarter (Stanger Science)

The Review identified areas where further information were required, such as likely noise impacts from construction and demolition, issues surrounding transport of materials and possible noise impact, dust generation and details of environmental controls. The Review recommended the use of Planning Conditions to ensure undertakings in the environmental statements, the preparation of environmental management plans and adopting a noise framework strategy. This proposed strategy consisted of modelling noise impacts, setting noise limits, undertaking noise monitoring and a liaison team to oversee the environmental management among the various developments.

Code of Construction Practice (CoCP)

The CoCP was intended to be a tool for controlling and minimising environmental impacts during the construction phase from the developments individually and collectively. Under the CoCP the developers shall establish a MQ Liaison Team for the management of the cumulative environmental impacts. The Liaison Team will provide a forum to enable developers to consider the cumulative impact of their construction activities and minimise it. Each developer was required to produce project specific Environmental Management Plans, which would set limits for identified aspects and refer to the total impacts from the MQ development.

The Council considers the cumulative impact of construction is a material planning condition and takes account of the screening criteria of Schedule 3 of the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999, which requires public bodies to have regard to cumulative impact[10]. The CoCP reflects the aims of the Council's Environmental Health Environment, which are to ensure that the control of environmental issues is co-ordinated, thereby reducing the potential impacts[11].

Policy Context

A "*key objective of the Council is to ensure that the environment of the borough is protected from disturbance, nuisance and pollution*" UDP (LBTH, 1998, p. 64) and the Key Issues Paper prepared as part of the UDP Plan Review (LBTH, 2002, p.11). To support this objective are environmental protection policies (e.g. Policy DEV 2 refers to the protection of residents from the effect of pollution, loss of privacy and deterioration of day lighting conditions and DEV 50 refers to the noise generated from developments and the measures that the Council seeks to control these impacts). The UDP further stated that "Tower Hamlets is a densely developed inner urban area in which few development sites are far from large population concentrations and the environmental implications of large developments can have a significant impact on the quality of life for large numbers of residents.

Network Diagrams

Documentary sources used to construct diagrams included: the Cumulative Impact Study (CIS) (Environ, 2001); the EISs of the proposed developments (Arrowhead Quay; 4 Mastmaker; Millharbour; Docklands Centre; World Trade Centre London (WTCL 1,2,3,4 and 5); the Transport Model Update and Forecasting Study Report (Arup and Partners, 2001); the Sustainability Appraisal of the UDP (Tower Hamlets, 2002): the adopted UDP (Tower Hamlets 1998); the Isle of Dogs Planning and Regeneration Framework (1999); Key Issues Paper (2002) and other local authority reports.

[10] As stated in the Case for the Council, Inspector's Report (2002).
[11] Inspector's Report (2002) ibid.

Box 5: Tower Hamlets Documentation

Arup Transport Planning (2001) *Millennium Quarter Master Plan: Transport Update and Forecasting Study Report.*
Carnegie Holdings (2000) Southport, *4 Mastmaker Rd London Environmental Impact Statement (EIS).*
EDAW (2000) *Millennium Quarter Master Plan.*
Environ (2000) *Docklands Centre EIS.*
Environ (2001) *Cumulative Impact Study Summary: Millennium Quarter Developments.*
Environ (2001) *Cumulative Impact Study Supplementary Technical Report: Millennium Quarter Developments.*
Environ (2001) *Arrowhead Quay EIS.*
Environ (2001) and 92002) *1 Millharbour EIS.*
Government Office for London (2002) *Appeal by Weston Homes plc Site at 41 and 43 Millharbour, London E14.* Inspector's Report
London Borough of Tower Hamlets (1998) *Unitary Development Plan.*
London Borough of Tower Hamlets (1999) *Isle of Dogs Planning and Regeneration Framework.*
London Borough of Tower Hamlets (2001) *Millennium Quarter Development.*
London Borough of Tower Hamlets (2002) *Environmental Appraisal of the Adopted Unitary Development Plan.*
London Borough of Tower Hamlets (2002) *Key Issues Paper.*
Stanger Science and Environment (2001) *Review of Environmental Assessments for the Millennium Quarter.*
Williams, David (2003) *Millennium Quarter Update.* LAP Conference, Jack Dash House, Isle of dogs 25 January 2003.
Isle of Dogs Community Foundation (2003) *A Consultation and Baseline Study.*
Waterman Environmental (2000) *World Trade Centre London Buildings 1, 2 & 3 EIS.*
Waterman Environmental (2000) *World Trade Centre London Buildings 4 & 5 EIS.*
Minutes of the Blackwall/Cubitt Town; Millwall Local Partnership Area Meeting (Area 8). 8 April 2002. [online] available at http://www.towerhamlets.gov.uk (accessed 30 July 2003).
Minutes of the Council Meeting - 5 March 2003: Questions and Answers (Discussed environmental issues relating to developments in the Millennium Quarter [online] available at http://www.towerhamlets.gov.uk (accessed 12 August 2003).

6.3.3 Creekside

There have been several initiatives to regenerate the area through: two Single Regeneration Budget (SRB) Programmes, the Greenwich Development Agency and Creekside Initiative and other development projects in the area. In 1995 £8.2 million as a Single Regeneration Budget (SRB) Round 2 from central government was granted to the Creekside Regeneration Project (Bertrand, 2002). The purpose was to co-ordinate improvements to the area, attract investment, promote redevelopment of derelict sites, protect and enhance the local environment. There are regeneration opportunities with the proposed demolition of the New Haddo Estate and the possible redevelopment of landholdings around Greenwich station.

Policy Context

Both UDPs and the area development frameworks (WGDF and CSDF) contain policies relating to the development of Creekside. Policies in the UDP (Greenwich Council, 1994) relevant to the area:

- Mixed use area (Policy J18): the Council is anxious to bring land that is currently under used into more productive use, particularly employment generating uses.
- Industrial Development Area (Policy J29): Improvement areas to facilitate regeneration and environment of working areas. The area to the ease of Deptford Creek and around Greenwich Station is designated as an improvement area to facilitate regeneration and improve the environment.
- Area of stress: The estates bordered by Bardsley Lane, Norman Road, Haddo Street and Tarves Way are designated as an 'Area of Stress'. The Index of Deprivation (1998) identified it as an 'Area of Deprivation'

In relation to co-ordination with Lewisham Council, the WGDF states that it is important that both boroughs co-ordinate their respective actions on policies in relation to the regeneration of the Creekside Area. This was recognised when the two boroughs adopted the Creekside Strategy in 1993 and further reinforced at various consultation events undertaken as part of the Implementation Strategy (July 1999) and the Creekside Forum 'Have your Say Day' (February 1999) (WGDF, p.4).

In Lewisham Council's UDP adopted in 1996, the Creekside area was designated as a Primary Employment Area and relevant policies are EMP2 and EMP3. Policy EMP2 states that the Council will grant planning permission for B1, B2 and B8 Uses in the area subject to the proposed developments not causing serious nuisance thrugh visual intrusion, noise, vibration, air pollution or traffic generation to adjoining areas or to the surrounding areas, in accordance with Policies BLT ENV1, BLT ENV 3 and TRN22.

In addition to those employment-based policies, the UDP designated the whole of the area of the Creek itself as an Area of Nature Conservation Importance. NATENV16 state that development within or affecting areas of nature conservation importance will not be permitted except when an assessment of ecological impact indicates:

- there is not actual or potentially significant damaging impact on the value of the area for nature conservation;
- it meets the criteria in Policies NATENV2 and NATENV5.

The Lewisham Council UDP 2000 (Lewisham Council) defines the western boundary of the Creek and the area south of the railway viaduct between Creekside and the Dreek as a Site of Nature Conservation Importance to which Policies OS11 and 12 would apply. Policy OS11 state that the development on or within the area will not be permitted if it is likely to destroy, damage or adversely affect the protected environment. Policy OS12 states that the Council will have regard to the nature conservation values of all sites in the Borough that are proposed to be developed, and seek to protect and enhance those, either through imposition of planning conditions or through ensuring alternative equivalent new habitat provision nearby.

Network Diagrams

Activities which could lead to cumulative effects were identified from information from UDPs, sustainability appraisals, committee reports, area development frameworks (WGDF and CADF), Environment Agency reports and EISs. Some EISs mention cumulative impacts (Greenwich Meridian and Norman Road Wharves) but the scope of these assessments are limited to the immediate area. The report, Deptford Creek: surviving regeneration (Steele, 1999) provides information on baseline surveys, which characterised the ecological and archaeological features of the Creek.

Network diagrams were drawn up using data from EISs (Meridian Gateway, Norman Road Wharves), environmental reports (Greenwich Reach, Laban Centre), transport studies (Greenwich Council) and other relevant reports. There were some quantitative data relating to transport and waste.

Box 6: Creekside Sources of Information

Bertrand, N. (editor) (2002) *Deptford Creek: life on the edge*. Creekside Environmental Project
Buro Happold (2002) *Redevelopment of Convoy's Wharf EIS.*
Clearwater Estates (undated) *Greenwich Reach Developments.*
EDAW (2001) *Creekside Urban Design Framework.*
GEMS (1998) *Norman Road Wharves Development Preliminary EIA.*
GLA letter to Greenwich Council Planning Officer commenting on Meridian Gateway application. 1 May 2003.
GLA letter to Head of Planning, Lewisham Council commenting on the Meridian Gateway application. 1 May 2003.
Greenwich Business Support Services (undated) *Greenwich Quarter: timed for success.*
Greenwich Council (1994) *Unitary Development Plan*
Greenwich Council (2002) *Unitary Development Plan – First Deposit Draft.*
Greenwich Council (Strategic Planning) (2000) *West Greenwich Development Framework.*
Greenwich Council Committee Meeting 19 May 2003 minutes. [Included Planning Officers Report on Meridian Gateway planning application.
Greenwich Development Agency (2002) *Creekside Renewal: Building Bridges.*
Greenwich Council (2002) *Sustainability Appraisal.*
Lewisham Council (2001) *Creekside Area Development Framework – Consultation Draft.*
London Borough of Lewisham (2000) *Environmental Appraisa.l*
London Borough of Lewisham (1996) *Unitary Development Plan*
London Borough of Lewisham (2000) *Unitary Development Plan.*
London Borough of Lewisham (2003) *Minutes of the Strategic Planning Committee on Tuesday 8 April 2003.* [Discussed planning application for Meridian Gateway – particularly concerns about its cumulative impact on public transport infrastructure. [online] available at http://www.lewishm.gov.uk/Council Meetings/ (accessed 4 August 2003).
Ove Arup and Partners (1999) *Laban Dance Centre Transport Assessment.*
Ove Arup and Partners (2001) *Meridian Gateway (Roseberry Homes) EIS.*
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Ove Arup and Partners (2003) *Meridian Gateway (Roseberry Homes) EIS Supplementary Information.*
Steele, J. (editor) (1999) *Deptford Creek: Surviving Regeneration.* London: Deptford Forum Publishing
Transport for London (undated) *Measuring Public Transport Accessibility Levels.*

6.3.4 Ebbsfleet

Initiatives to plan and promote the Ebbsfleet area go as far back as 1993, when the Kent Thames-side Association (KTA) was set up. The KTA is a group of private and public sector interests including: Darford and Gravesham Borough Councils, Kent County Council, Whitecliff Properties (the largest owners of potentially developable land in the area), the University of Greenwich and London & Continental Railways, the company responsible for the Channel Tunnel Rail Link. Agendas are shared across a wide range of topics including integrated transport, housing, job cration, regenration, education leisure and issues.

In 1995, the KTA published it vision for the area, *Looking to the Future* (KTS, 1995). Key components of the vision are five substantial, new, mixed use development areas not previously identified in structure plans or local plans: Ebbsfleet, Eastern Quarry, Greenhithe Waterfront, Swanscombe Peninsula and Northfleet Embankment. Thus, the development of Ebbsfleet is set within this context. The aim of KTA was to complement and assist the local authorities by developing a vision for the development in the area and tackling complex regeneration issues of a technical nature. There has been three strands of activity as far as technical work is concerned: i) provision of utilities, like electricity and water supply, ii) land use and the quantification of the capacity of potential development sites in the area on the basis of mixed use and public transport oriented development, and iii) the form of the new local public transport system. In addition, an important element of the Vision for Kent Thames-side is the concept of the 'green-grid', a network of inter-connecting strategic green corridors permeating through the urban area to serve as corridors of movement for walkers and cyclists (KTS, 1999).

Ebbsfleet Valley occupies 190 hectares and is bounded to the east by Springhead Road, Northfleet; to the west by Stanhope Road/Southfleet Road/High Street, Swanscombe; to the south by the A2 and to the north by the North Kent Railway Line. Major quarrying has resulted in the Blue Lake and Bamber Pit, which is used for the disposal of works waste. To the south is Northfleet Landfill (Baker's Hole-SSSI) which ceased operation in 1994 and is being restored and the Southfleet quarry area which was backfilled and returned to agriculture.

The Ebbsfleet Framework was prepared in order to:

- take forward the local authorities' adopted objectives and provide planning guidance for the CTRL, Ebbsfleet Station and development proposals;
- identify development potential;
- safeguard areas of acknowledged archaeological, nature conservation and landscape importance;
- establish principles for sustainable development, transport and environment against which proposals can be assessed;
- co-ordinate the planning of government and specialist agencies, landowners and service providers;
- establish principles for the integration of development with the existing communities.

A major consideration in the area is the Channel Tunnel Rail Link (CTRL) and the proposed Ebbsfleet International and Domestic Station. Ebbsfleet Station has an important role in the regeneration of Kent Thameside and North Kent by becoming a major focus for investment and development for the next twenty years.

The Ebbsfleet Developments cover an area of 200 acres and consist of:

- an International and Domestic Passenger Station, a key passenger rail interchange between the CTRL and Connex;
- a business district with mixed use scheme including housing, leisure, retail, civic and commercial buildings to be built around the station;
- an urban village in Springfield.

Fundamental to the development of Ebbsfleet is the discouragement of car use, where the principle of 'public oriented development' has been recognised. The planning approval has been granted on the basis that no more than 37% of journeys to and from the new development (excluding the station) will be by car. To achieve this, there was a need for:

- introduction of a high quality local public transport system linking Ebbsfleet with other key areas in the Kent Thames-side;
- a gradual reduction of the amount of parking spaces to serve new development as public transport services are improved; and

- the concentration of most intense developments in proximity to public transport services.

To address the latter, the project proponent devised a plot ratio plan in order to identify the relative concentration of development across the area and Use Classes were determined for each of the sub areas. The planning approval set upper and lower levels of permitted development for residential, employment and other uses.

Policy Context

The Ebbsfleet Framework has been prepared within the context of RPG 9a: the Thames Gateway Planning Framework and PPG 12 and PPG 13. Specific policies in the Framework relating to the environment include:

- P48: The local authorities will expect non-CTRL proposals in the Ebbsfleet Valley to incorporate a travel impact assessment, which will consider capacity deficiencies and environmental impacts;
- P52: The local authorities will expect non-CTRL proposals in the Ebbsfleet Valley to be accompanied by a full Environmental Statement, including consideration of the cumulative impacts of development;
- P56: The local authorities will expect those with an interest in pursuing proposals in the Ebbsfleet Valley to carry out a full ecological assessment of the cumulative impacts of development and infrastructure proposals followed by the submission of strategies, following consultation with the nature conservation bodies for: the protection of natural habitats; minimising damage to protected species and their protection and transference; habitat creation within the Valley and maintenance of new or managed habitats.

Network Analysis

As in previous case studies, EISs (CTRL; Ebbsfleet Devts; South Thames Development Road); committee reports; updated and detailed transport and ecological studies subsequently submitted as part of a planning condition for the approval of Ebbsfleet and other relevant documents provided information on potential impacts. In addition, the EIS of Eastern Quarry proposal, a large housing development over 310 hectares to be located between Bluewater and Ebbsfleet was examined to identify potential cumulative impacts resulting from these large developments. Outline planning permission for Eastern Quarry was submitted in 2003.

Box 7: Ebbsfleet Developments Sources of Information

Blue Circle Properties Ltd (1995) *Ebbsfleet EIS.*
Blue Circle Properties Ltd (1996) *Ebbsfleet Ecology and Nature Conservation Strategy*
Dartford Borough Council, Gravesham Borough Council and Kent County Council (1996) *Ebbsfleet Development and Environment Framework.*
Dartford Borough Council (1998) Minutes of Special Environmental Services Committee Meeting (Decision Notice – Ebbsfleet Developments)
Dartford Borough Council (1999) *Land at North Dartford*: Planning Brief.
Dartford Borough Council (2000) *Deposit Draft Local Plan Review Sustainability Appraisal*
Dartford Borough Council (2002) *Local Plan. 2nd Draft Deposit* [on line] available at: http://www.dartford.gov.uk (accessed 3 September 2003).
ERM (1994) *Channel Tunnel Rail Link EIS.*
Gravesham Borough Council (1997) *Land West of Springhead Road.*
Gravesham Borough Council (2000) *Sustainability Appraisal of the Local Plan 2nd Review Deposit Version.*
Gravesham Borough Council (2000) *Local Plan Deposit Version* [online] available at http://www.gravesham.gov.uk/Localplan (accessed 15 July 2003)
Dartford Borough Council (2002) *Eastern Quarry Planning Brief.* Supplementary Planning Guidance.
Kent County Council Highways and Transportation (1995) *South Thames-side Development Route EIS.*
Kent Thames-side Partnership (1995) *Looking to the Future*
Kent Thames-side Partnership (1999) *Looking to an Integrated Future: Land use and transport planning in Kent Thames-side.*
Kent Thames-side Partnership (2000) *Draft Economic Strategy for Kent Thames-side 2001-2006.* [online] available at: htttp://www.kt-s.co.uk (accessed 5 March 2001)
Kent Thames-side Partnership (2003) *Realising the Potential.*
Land Securities (2003) *Eastern Quarry EIS*
Land Securities (2003) *Ebbsfleet Transport Strategy*
Land Securities (2003) *Springhead Quarter Air Quality Strategy*
Land Securities (2003) *Springhead Quarter Transport Strategy*
Thames Gateway Kent Partnership (2002) *The North Kent Area Investment Framework.*

6.3.5 Thames Estuary Flood Risk Management Plan of the Environment Agency

The strategic aim is to develop a Flood Management Plan for London and the Thames Estuary for the next 100 years that is risk based and takes into account all existing and future assets, is sustainable and involves all stakeholders (Environment Agency, 2003b).

This strategy will develop a framework for managing flood risk in the Estuary and those who have planning and development responsibilities within the Estuary will be actively involved. The framework will include defences and other methods of risk reduction and will address environmental and social sustainability over the next 100 years and will take account of future development. The benefits of adopting this approach include the following:

- Improved understanding of the factors that affect the height of tides and surges which result in an increase in sea level, including climate change
- Improved understanding of the response to the estuary of changes in the height of tides, surges and other factors that affect predictions of flooding
- Improved understanding of the risks to existing and proposed assets (natural and built environment) currently and in the future

Early dialogue and partnership with stakeholders particularly Thames Gateway strategic planners and developers was undertaken. A Project Appraisal Report (Environment Agency, 2003b) provides details on the activities during each phase. Phase 1 will include the development of an overall flood defence management framework for the 33 management plans and strategies relating to tidal defences in the Thames Estuary. A decision framework for dealing with 'priority works' which is acceptable to DEFRA and the local Agency teams managing these flood defences is to be established. So far, scoping has been conducted and baseline studies are being undertaken. Scoping was undertaken to:

- Obtain support for the framework
- Identify gaps in data and framework guidelines
- Facilitate a systematic, open and transparent approach to environmental processes
- Initiate a process of ongoing, active consultation within and external to the Agency

The overall aim of the SEA of the Thames Estuary Flood Risk Management Plan is:

'to protect the environment, minimise the environmental impacts resulting from future Flood Risk Management on the Thames Estuary and ensure opportunities and partnerships are realised to enhance the environment' (Environment Agency, 2002).

Box 8: Thames Estuary Flood Risk Management Plan Sources of Information

DEFRA and Environment Agency (2002) *Guidance Notes for Assessing Morphological Change in Estuaries.*
Environment Agency (2002) *Thames Estuary Flood Risk Management Plan: Strategic Environmental Assessment Inception Report*
Environment Agency (2003) Project Appraisal Report: Thames Estuary Flood Risk Management Plan.
Environment Agency (2003) *Planning for Flood Risk Management in the Thames Estuary: Strategic Environmental Assessment Inception Report and Phase 1 Scoping.*
Foresight: Flood and Coastal Defences Project Proposa.l [online] available at : http://www.foresight.gov.uk (accessed 28 October 2002).
Lavery, S. (2001) Planning for Flood Risk Management in the Thames Estuary. Talk of the Thames. London: Thames Estuary Partnership.
Ministry of Agriculture, Fisheries and Food (2000) *Flood and Coastal Defence Project Appraisal Guidance: Environmental Appraisal.*
Ministry of Agriculture, Fisheries and Food (2001) *Flood and Coastal Defence Project Appraisal Guidance: Strategic Planning and Appraisal.*
Planning for Flood Risk Management in the Thames Estuary. People and the Environment Workshop. Museum in Docklands. 10 June 2002.
Parker, D.J. and Penning-Rowsell, E. C. (2002) *The Case for Flood Protection for London and the Thames Gateway.* Flood Hazard Research Centre. Middlesex University.
Spearman, J. and Chester, T. (2002) *Best Practice in Estuary Studies.* Paper presented at the Workshop on Estuaries Research Programme Phase 1 Uptake Project at DEFRA, Page Street, London. 5 November 2002.
Thames Estuary Partnership (1996) *Thames Estuary Management Plan Draft Consultation Document.*

Appendix 7: Evaluation Questionnaire

Draft Guidance on Cumulative Effects Assessment of Plans

Name:_____

Organisation: _____

Please answer both questions in Part A and comment on the contents and presentation of each guidance section in Part B. Please could you e-mail your reply to me at: lourdes.cooper@imperial.ac.uk or send your comments to: Lourdes Cooper, Environmental Policy and Management Group, Department of Environmental Science and Technology, Imperial College London, 4th Floor RSM Building Prince Consort Road London SW7 2BP. Thank you very much for your time.

Part A : Overall opinion

1. Is the guidance a useful contribution to the field of SEA and CEA of plans and do you think SEA/sustainability appraisal practitioners and planners could use it?

2. Is the guidance clearly presented, logical in sequence and practical?

Part B: Comments on Sections

Section 1: Introduction, Background and Context

Section 2: Cumulative Environmental Assessment Framework: Guiding Principles

Section 3: Approach to Cumulative Effects Assessment

Section 4: Screening

Section 5: Scoping

Section 6: Baseline Conditions

Section 7: Assessment of Options, Policies and Proposals

Section 8: Mitigation Measures

Section 9: Monitoring and Management Programme

Section 10: Documentation of findings on CEA

Section 11: Quality Assurance

Other comments:

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Cumulative effects assessment: A review of UK environmental impact statements

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Abstract

The consideration of cumulative effects in environmental impact assessment (EIA) has been required in the UK, though somewhat ambiguously, since the EC Directive (85/337/EEC) was implemented in 1988. This paper describes the results of a review of cumulative effects considerations in 50 UK environmental impact statements (EISs) prepared for a variety of project types produced between 1989 and 2000. The results of the review suggest that cumulative effects are far from thoroughly addressed. Only 24 EISs (48%) mentioned the term 'cumulative effects/impacts' and only 9 EISs (18%) provided a discussion, which were mostly qualitative. The problems in addressing these issues are explored, and the main findings include the various interpretations of the concept of cumulative effects and the varied treatment of cumulative effects issues. Where cumulative effects are considered in the scoping stage, this led to a further discussion or analysis of these effects. The research concludes that for a better consideration of cumulative effects, an effective driving force would be the local planning authority (and other competent authorities) requiring developers during the scoping process to address cumulative effects and so help meet the most recent strengthened legal requirements of the EC EIA Amendment Directive 97/11/EC and UK Regulations. More tailored guidance for developers and authorities alike is needed for this to happen.
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Keywords: Cumulative effects assessment (CEA); Habitats directive; Ramsar sites; Site of Special Scientific Interest (SSSI); EIA; SEA

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1. Introduction

This paper examines the extent that cumulative effects are considered in environmental impact statements (EISs) in the UK. The results of a review of a sample of 50 EISs are described, and deficiencies in the consideration of cumulative effects are identified. Some of the issues explored are: whether the lack of an accepted definition of cumulative effects has been a limiting factor in undertaking cumulative effects assessment (CEA); whether scoping has an important role in ensuring that these effects are considered in the environmental impact assessment (EIA); and whether certain projects, which are part of planned developments, such as urban regeneration projects, are more likely to consider these effects. In the final section, the paper presents suggestions for improving the quality of CEAs in environmental assessments (EAs).

The assessment of cumulative effects in UK EISs has been perceived generally as poor (Glasson et al., 1995; Pritchard, 1993; Fuller and Sadler, 1999). Previous reviews of EISs, which have been concerned with their overall quality (Jones et al., 1991; Therivel et al., 1992) or their ecological assessment, have noted that cumulative effects were not assessed (Treweek et al., 1993; Royal Society for the Protection of Birds (RSPB), 1995; Byron et al., 2000).

In the European Union, the assessment of cumulative impacts or effects of certain public and private projects has been required since the EC Directive (85/337/EEC) on EIA was issued (Commission of the European Communities (CEC), 1985). Cumulative effects are referred to in Annex III of the Directive in which the description of the likely significant effects of the proposed project on the environment should include cumulative effects. The Directive was originally implemented in the UK under the Town and Country Planning (Assessment of Environmental Effects) Regulations 1988, which refer to cumulative effects in Schedule 3 as optional information to be included in the environmental statement.

More recently, the Amendment Directive 97/11/EC, which became effective in 1999 amending Directive 85/337/EEC, makes a further reference to cumulative impacts. This Directive states that in the criteria for selecting projects to be assessed, the characteristics of projects must be considered having regard to the 'cumulation with other projects' and the environmental sensitivity of areas likely to be affected (Annex III, Commission of the European Communities (CEC), 1997).

This Directive is implemented in the UK inter alia through the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999, SI 1999 No. 293, with the provisions also referring to the 'cumulation with other projects' in the Selection Criteria for Screening Schedule 2 Development. These Regulations, however, unlike the EC Directives and previous 1988 UK EIA Regulations, list cumulative effects alongside direct and indirect effects in the main text of Schedule 4 (Part I), where such information is now conditional, rather than ambiguous (as in Directive 85 337 EEC) or optional (as in the 1988 Regulations). This Schedule (Part I) states that,

"a description of the likely significant effects of the development on the environment, which should cover the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the development ..." be included in environmental statements. This information is conditional inasmuch as the information in Schedule 4 Part I, "... is reasonably required to assess the environmental effects of the development and which the applicant can, having regard in particular to current knowledge and methods of assessment, reasonably be required to compile ..." (Regulation 2 (1)). This is potentially much stronger than the wording in the 1988 Regulations where information on cumulative effects was entirely optional on the developer. The listing of cumulative effects along with direct and other effects implies that a similar level of importance should be attached to cumulative effects as to other effects in the list, which may have implications as to how cumulative effects are treated in future EIAs. The conditionality highlighted above can, most probably, best be determined at the scoping stage by the competent authority, where the legislation may now provide more support in requiring such assessment.

Another legislation that refers to cumulative or combined impacts is the Habitats Directive (92/43/EEC). This Directive requires that an 'appropriate assessment' should be conducted when "a plan or project is likely to have a significant effect on the site (special area of conservation) either individually or in combination with other plans or projects" (Article 6, Commission of the European Communities (CEC), 1992). The Directive is implemented in the UK as the Conservation (Natural Habitats & C.) Regulations (SI 1994 No. 2716). The Regulations propose that 'appropriate assessment' be carried out by a competent authority before authorising "a plan or project which is likely to have a significant effect on a European site in Great Britain (either alone or in combination with other plans or projects)" (Department of Environment (DOE), 1994, p. 26). A 'European site' in this context refers to a special area of conservation (SAC), a site of community importance or a designated special protection area (SPA) for birds.

However, there are a number of issues concerning the consideration of cumulative effects in EIAs. First, there is no definition of cumulative effects or impacts and no specific requirements in the legislation as to how cumulative effects could be addressed. Second, the guidance to the procedures (DOE, 1989; Department of Environment, Transport and the Regions (DETR), 1999) do not mention methods or frameworks for the assessment of cumulative effects. The lack of guidance and frameworks for the assessment of cumulative effects in the UK are some of the constraints for EIA practitioners, who have had to rely on international standards (Fuller and Sadler, 1999). Guidance for the assessment of cumulative effects include those from the USA and Canada (US Council on Environmental Quality, 1994, 1997; Lane and Wallace, 1988; Cumulative Effects Assessment Working Group and AXYS Environmental Consulting, 1999). However, the above guidance,

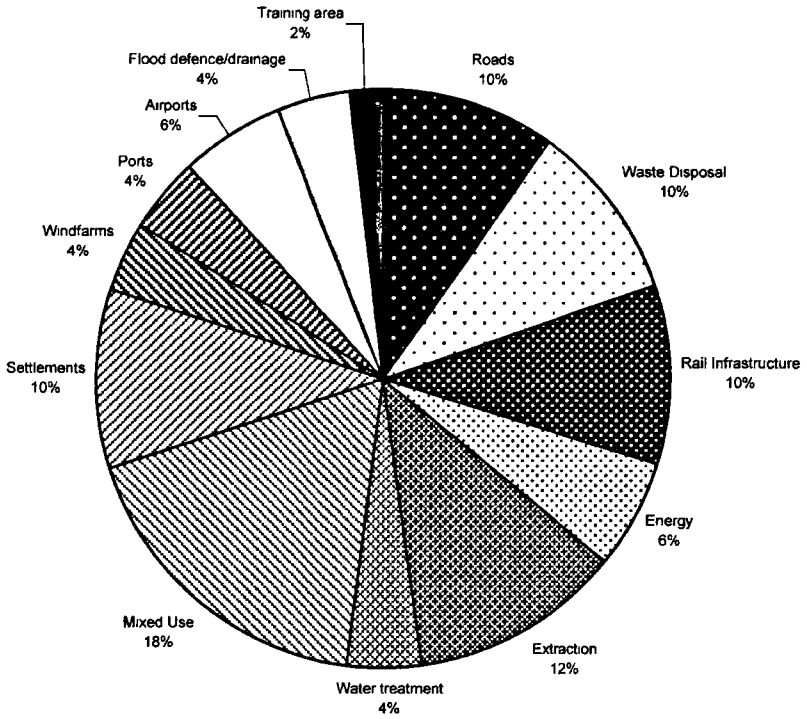


Fig. 1. EIS sample project types.

although helpful, were designed to fit these countries' EIA procedures, which vary from the EIA implementing procedures in the UK. The EC Guidance on CEA (Hyder, 1999), which was issued more recently, unfortunately fails to make a framework for CEA more explicit (Fuller and Sadler, 1999). Another issue is the importance attached to cumulative effects in the decision-making process, which may have implications for whether these cumulative effects are even considered in the first place. For example, Dodd (1996) noted that there is a general perception that cumulative effects cannot be used for refusing planning permission.

2. Method for the review of EISs

A sample of 50 EISs in the EIS collections held by the Department of Environment, Transport and the Regions (DETR),[1] Department of Environmental

[1] Since June 2001, the Department of Transport, Local Government and the Regions (DTLR).

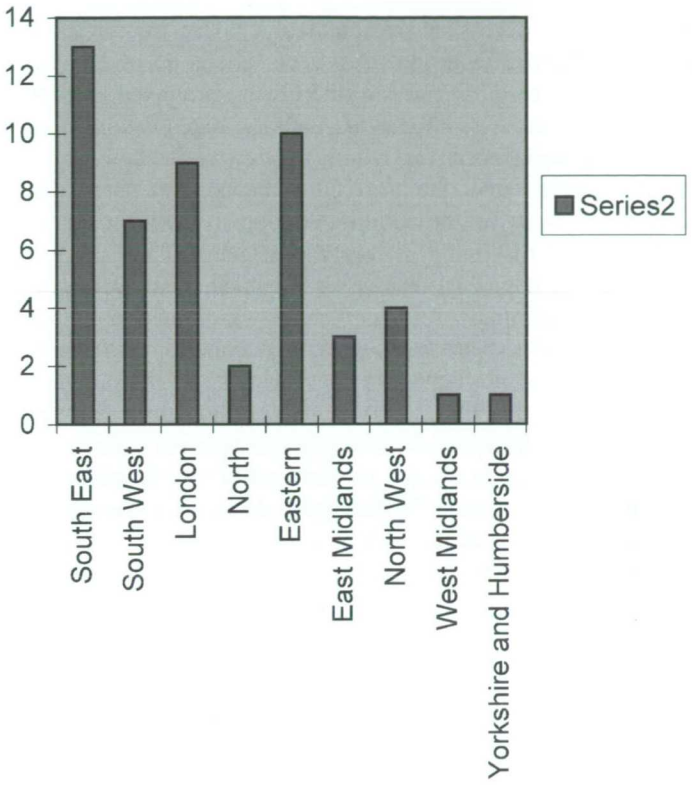


Fig. 2. EIS sample by regions.

Science and Technology at Imperial College, as well as those provided by personal contacts, were reviewed. The sample consisted of various types of projects and geographical locations. Fig. 1 illustrates the composition of EISs reviewed, grouped into broad categories of development. Fig. 2 shows a breakdown of the EISs by regional location, and a list of the EISs reviewed is shown in Appendix A.

Although the EISs were randomly chosen from the EIS sources mentioned above, a stratified sampling procedure was followed. Within the sample, three subsamples were included: urban regeneration projects (8 EISs), a number of projects in a subregion, the Thames Gateway area[2] (13 EISs) and eight pairs of projects located adjacent to each other or within a defined area. Urban

[2] The Thames Gateway is a major region of planned development and regeneration and lies to the east of London, including inner and outer London boroughs, such as Greenwich, Lewisham, Newham, Tower Hamlets and parts of the counties of Essex to the north of the River Thames and Kent to the south of the river.

regeneration projects were seen as potentially having significant effects (e.g. traffic and air pollution) requiring serious consideration of cumulative effects particularly because these projects are often being promoted as part of planned programmes of associated developments within a regeneration framework. The Thames Gateway was chosen as being an area targeted for rapid and programmed development over the next 20 years, and the particular focus for current research activity by the authors. Among the remainder, as balanced a sample as possible across other sectors was selected. The EISs were prepared from 1989 to 2000, with 24 (48%) EISs prepared in 2000 and 4 (8%) EISs prepared in 1999. The sample of EISs reviewed was limited to the EISs that were available in the libraries mentioned above. Any conclusions from the study are therefore indicative and not definitive. The majority of the sample (56%) were recent EISs (prepared in 1999–2000) to give an indication of current practice. Apart from the main EIS report, other relevant documents were examined, which included the nontechnical summary, supplementary reports, planning statements and scoping reports. The reason for examining documents other than just the EIS was to get a better picture of the EIA process as a whole, rather than just what was reported in the EIS. The aim of the review, therefore, was to investigate the

Table 1
Review categories and examples of review criteria

Review categories	Review criteria
Consideration and documentation	EIS documentation mentions cumulative effects
Concepts of cumulative effects	EIS/documentation defines cumulative effects
	EIS/documentation refers to cumulative effects indirectly: combined effects, in-combination effects, interaction of effects
Scoping	EIS/documentation identifies cumulative effects issues
	EIS/documentation establishes spatial boundary for the analysis
	EIS/documentation establishes temporal boundary for the analysis
	EIS/documentation identifies VECs
	EIS/documentation identifies other activities/developments affecting VECs
Baseline conditions	EIS/documentation characterises resources identified in scoping
	EIS/documentation characterise stresses affecting these resources
	EIS/documentation defines baseline conditions of affected environment
Identification, prediction and evaluation of effects	EIS/documentation identifies potential cumulative effects and cause effect relationships
	EIS documentation considers cumulative effects: for all affected resources or selected resources
Methods	EIS/documentation mentions guidance and methodologies used
	EIS/documentation describes qualitative analysis
	EIS/documentation describes quantitative analysis
Evaluation of significance	EIS/documentation describes criteria for evaluation of impact significance
	EIS/documentation refers to existing thresholds and indicators
Mitigation	EIS/documentation proposes mitigation measures and indicates their effectiveness
	EIS/documentation considers residual impacts after mitigation
Monitoring and effects management	EIS documentation includes proposals for monitoring and management of cumulative effects

extent that cumulative effects are considered in EIAs, rather than simply the quality of the EISs themselves.

The detailed review criteria were based on CEA evaluation frameworks (US CEQ steps in CEA, 1997) and Burris and Canter's (1997) criteria questions. In applying these criteria, a modified procedure was developed that was appropriate to the UK context, after consulting the guidance on EAs (DOE, 1989, 1995; Department of Environment, Transport and the Regions (DETR), 1999). Hopefully, the criteria could be used in future reviews of cumulative effects considerations of EIAs and EISs in the UK.

The review process focused on the concepts of cumulative effects, the approach to CEA, methods used to identify and predict cumulative effects, any proposals for mitigation and monitoring measures. The review also investigated whether the EIA process allowed for the consideration of cumulative effects by examining the different stages of the process and their documentation. Furthermore, since one of the reasons suggested in the literature as to why cumulative effects are not addressed in UK EIAs is due to the lack of guidance, the review investigated if any guidance was referred to and whether the EC Guidance published in 1999 had been used in recent EIAs. The review criteria schedule is summarised in Table 1.

3. Results from the review of EISs

3.1. Concepts of cumulative effects and documentation

The results from the review are summarised in Table 2. Only 24 (48%) EISs mentioned the term 'cumulative impacts/effects.' A further four (8%) EISs

Table 2
Analysis of the sample of environmental impact statements

Sample of environmental impact statements	50 EISs		EISs
Mentioned 'cumulative effects'	24	No mention of cumulative effects	26
Provided a definition of cumulative effects	8		
Referred indirectly to cumulative effects by using the following terms: combined effects; in-combination effects or interaction of effects	4		
Identified potential cumulative effects	15	Concluded that there were no cumulative effects without any assessment	1
Considered cumulative effects	13	Concluded that cumulative effects were insignificant without assessment	4
Addressed cumulative effects by providing some analysis	9		
Discussed cumulative effects for all affected resources	5	Discussed cumulative effects for some affected resources	4
Identified other developments	1	Identified other developments	3
Identified only similar developments or actions	2	Identified only similar developments	1
Identified one other action	2	Identified no other actions	0

referred indirectly to cumulative effects through the use of the following phrases: in-combination effects, combined effects or effects interactions.

The term 'cumulative effects' was mentioned in the nontechnical summary, table of contents or introduction in 18 (36%) EISs, while 5 (10%) EISs mentioned the term in the EIS, 1 EIS referred to cumulative effects in a letter to the competent authority and 1 EIS mentioned the term in the planning statement. Of the EISs that mentioned 'cumulative effects,' 11 (22%) EISs were prepared in the year 2000 (out of 24 prepared in the same year), which seem to suggest an increasing awareness of these effects in more recent EISs.

Eight (16%) EISs provided a definition of cumulative effects. Some of the definitions of cumulative effects were:

- "the impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions" as defined in National Environmental Policy Act (1969) (Isle of Grain EIS and Woodville EIS);
- "an analysis of the consequences of more than one direct and/or indirect impact acting together" (Barrow, 1997) in (Westhay Heath EIS);
- "if there is more than one factor from a site impacting upon the local population and/or the local environment this would be a cumulative impact, for example, noise and dust" (Kingsnorth Landfill Site EIS);
- "cumulative impacts relate to the sum total of the effects of either individual operations or entire schemes on a single person, the community or the local environment over a period of time" (Woodhead EIS);
- "cumulative effects arise from accumulation of a number of effects, either:
  - of a different nature at a particular location ...;
  - at different locations but affecting the same resource ...;
  - of the same nature at different locations ...; or
  - over a period of time" (Channel Tunnel Rail Link (CTRL) EIS).

The definition provided by the CTRL EIS was the most comprehensive. One EIS (Rochdale) commented on the lack of guidance on assessing cumulative effects but consulted the Institute of Environmental Assessment and interpreted cumulative effects in terms of:

- "effects of development over time (i.e. 'residual' effects);
- effects of development in terms of space elsewhere (i.e. 'off-site' effects);
- effects of development in relation to other effects (i.e. 'synergistic' effects)."

One EIS (Otterburn) observed that there is no accepted definition of cumulative effects, but three types of cumulative effects to be considered were suggested in the scoping process:

- the 'additive' effect of proposals that individually are of minor/moderate significance, but in total have an effect of major significance;

- incremental effects, the effect of what is proposed, taking into account existing activities and developments and their interactions with the environment;
- where the level of effect reflects the timing of impacts over a certain period.

Other EISs that mentioned cumulative effects put forward the following concepts of cumulative effects: as changes in environmental quality, the sum of direct and indirect impacts, residual impacts after mitigation and the combined effects of individual impacts from developments on receptors. As can be seen from the above definitions, there are various interpretations of the concept of cumulative effects. The situation is further complicated by the requirement under the Habitats Directive, which introduces the concept of in-combination effects.

The results of the review revealed the following concepts regarding cumulative effects:

1. cumulative effects as residual effects (Thameside Gas Pipeline and Beldevere Combined Heat and Power Plant EISs);
2. cumulative effects as a combined effect by two projects (the CTRL and M2 EISs, Testwood Lakes EIS and the Heathrow Express (considering Heathrow Terminal 5 ES));
3. interactions of impacts of the project (Stonecastle Farm Quarry EIS and Westhay Heath EIS);
4. impacts from the proposed project and from other past, present and future projects/actions (Ebbsfleet Development, Trinity III Terminal Extension and the Ipswich New Quays EISs);
5. impacts of developments within a scheme (Swale Gateway EIS and Otterburn EIS).

The concept of cumulative effect adopted in an EIA subsequently influenced the range of impacts investigated in the process. In the first example, where cumulative effects are considered as residual impacts, the discussions were limited to the identification of what are the direct and indirect impacts that may remain after mitigation. The more constrained the concept of cumulative effects, such as those in Concepts 2, 3 and 5 (combined effects of two projects, interactions of impacts in a project or impacts of developments within a scheme), then the range of impacts investigated was limited to those elements. On the other hand, a broader concept of cumulative effects, such as in Concept 4, led to the consideration of impacts from a number of projects in the wider area.

The reporting and documentation of cumulative effects were generally poor, except for a few cases. Most of the EISs that mentioned cumulative effects in the introduction did not address cumulative effects further in the EIS. One EIS concluded that there were no cumulative impacts, yet without any analysis. There were six (12%) EISs that discussed cumulative effects in Section 1. The discussion consisted of definitions, types of cumulative effects and other

projects that should be considered. Cumulative effects were discussed more thoroughly in nine (18%) EISs that devoted a section in the main part of the EIS. In addition, the combined effects of the two projects CTRL and M2 motorway were discussed in a separate annex.

3.2. Scoping

The review examined the process of the EIA, such as the scoping stage. There were 30 (60%) EISs that mentioned conducting scoping: 23 (46%) EISs mentioned scoping and 7 (14%) EISs referred to consultations. Among those that conducted scoping, 8 (16%) EISs mention preparing scoping reports and 14 (28%) EISs mention considering cumulative effects in scoping. From these 14 EISs, nine (64%) EISs were prepared in the year 2000 and seven (50%) EISs were located in or adjacent to designated conservation sites (such as Sites of Special Scientific Interest (SSSIs), SPAs and Ramsar sites). In such cases, the scope of cumulative effects investigated was focused on those valued environmental resources.

The geographical scope for the investigation of cumulative effects was defined at different levels. These ranged from interaction of impacts within the development site (Otterburn, Swale Gateway EISs) to the cumulative impacts over an area covered by an SPA such as the Orwell and Stour Estuaries (Trinity III Terminal Extension and Proposed New Quays at Ipswich EISs) and the combined impacts along a corridor where the two schemes run parallel (CTRL and M2 widening EISs). The geographical scope for the analysis of the visual effects in Wharrels Wind Farm EIS ranged from fixed points (20–21 km) away and 'cross-country,' across the countryside for those travelling through the landscape.

The temporal frame for the analysis of cumulative effects has not been mentioned in most of the EISs. However, the temporal range for assessment of cumulative effects in the Trinity III Terminal Extension EIS was 5 years, and so all plans or projects underway or proposed within that time frame were included in the assessment. In the CTRL and M2 widening combined assessment, the temporal boundary was 20 years, which included both the construction and operational phases of both schemes.

In considering past, present and future activities and projects that may interact with the effects associated with the project, the coverage was uneven. There were 28 EISs that considered some aspects: 4 (8%) EISs discussed past and present projects only and 14 (28%) EISs mentioned present and future projects, while others only mentioned other present or past projects. There were seven (14%) EISs that did not mention other projects at all. Only 15 (30%) EISs described other past, present and future projects. Relevant future projects identified consisted of developments where planning permission had been granted, developments where planning permission has been applied for and proposed projects such as those identified in the Local Plan. Sources of information regarding

permitted developments were the local authority and for proposed developments, either the Local Plan or Local Studies, such as the Transport Study. Two EISs that provided a more thorough consideration of other projects were the Trinity III Terminal Extension EIS and the Proposed New Quay at Ipswich EIS. The former included all plans or projects underway or proposed within the estuary in the assessment. In the Proposed New Quay EIS, projects considered included developments within and adjacent to the SPA. Developments outside the SPA, but close to it, and its relevance were also taken into account, and whether the activities may result in potential disturbance to birds due to construction noise and movement.

3.3. Baseline conditions

The review examined the baseline conditions described. The aim was to assess the extensiveness of the baseline survey. To consider cumulative effects, the affected environment should be defined broadly to include any potentially significant effects occurring away from the immediate project area. Most EISs in the review limited themselves to the immediate area surrounding the project. The characterisation of the affected resources (e.g. air, water, landscape character) was undertaken adequately in most of the EISs.

Difficulties in characterisation of stresses were more evident. Stress factors pertaining to each resource were not adequately considered in general. Determining the threshold beyond which cumulative effects significantly degrade a resource or ecosystem is usually problematic, but for certain resources (air and water quality) where established thresholds were available, these were used. Some thresholds, such as significance of visual effects, are not easily determined, and those EISs that considered these effects (Wharrels Hill Wind Farm EIS and Rochdale EIS) relied to a great extent on professional judgement.

An example of an EIA, where the focus of the assessment is one valued resource, is the Trinity III Terminal Extension EIS. The important (valued) environmental characteristics or VECs were defined as the Stour and Orwell Estuaries SPA and the Trinity Marshes proposed SPA and its designated features, such as the population of waders and wildfowl and the habitat and resources that are required to support them. The key VECs considered in the assessment were the system hydrodynamics and the extent of the intertidal area. In addition, the combined effect of noise and light disruption to feeding and roosting birds in the vicinity of the development was also considered.

3.4. Identification, prediction and evaluation of effects

The review next investigated the identification, prediction and evaluation of cumulative effects in the EISs. As shown in Table 2, there were 15 (30%) EISs

Table 3
Project EIAs that addressed cumulative effects

Projects	VECs	Issues/impacts	Approaches	Mitigation measures	Determination of significance	Comments
Swale Gateway Development, 1994. Integrated assessment of four potential property development sites	Landscape character, visual amenity	Impacts upon landscape and views; traffic and disturbance of archaeological remains; water quality; proximity to SSSI	Professional judgement	Landscaping–peripheral screening	Landscape and visual effects not significant	Qualitative assessment of changes in landscape character and views; considered the combined effects of the four projects within the development
CTRL and M2 junctions (1–4) widening, 1994 • High-speed railway • Road widening	Landscape character; ancient woodland; agricultural land; surface and groundwater quality	Landscape and visual impacts; loss of ancient woodland; disruption to farming; traffic impacts during construction	Professional judgement	Landscaping–screening; fencing; traffic management plans; topsoil collection and reuse	Significant effects: loss of ancient woodlands; visual; heritage; landscape	Qualitative assessment of all affected resources; quantified assessment of noise from operations; considered the combined effects of the two projects
Ebbsfleet Development, 1995 • Mixed use developments including commercial, residential, leisure and	Landscape character; visual amenity; Ebbsfleet marshes, SNCI; water resources quality;	Change in landscape character; visual impacts; loss of reedbeds; habitat fragmentation; loss of grassland and vegetation; impacts on surface and groundwater; disturbance to	Professional judgement and use of findings from previous studies	Provision of additional wetland habitats; routing of surface run off; construction code of conduct to minimise cumulative impacts	Significant cumulative impact on Ebbsfleet Marshes SNCI	Qualitative assessment of all affected resources; considered other projects: CTRL, IPS, STDR and Ebbsfleet Development

commercial facilities	areas of archaelogical interest	archaelogical features; increase in traffic			
Wharrels Hill Wind Farm and Visitor Centre, 2000	Landscape character; visual amenity; tranquility	Increase in incidence of perception of wind turbines; impacts at fixed points and travelling (cross country effect)	Professional judgement; analysis of zones of visual influence; reference to public attitudes on wind farms	• visual effects not unacceptable	Qualitative assessment of visual impacts; considered similar developments—three other wind farms
Otterburn Training Area, 1995 • Road strengthening and widening; • New facilities for gun spurs . . .; • New accommodation blocks	Landscape character; visual amenity; recreation; heritage sites	Increase in scale of built development and activities; impact on views	Professional judgement	Minor/moderate effect on landscape character; moderate effect on views	Qualitative assessment of impacts on all affected resources; assessed alongside direct and indirect impacts; considered the effects of different actions within a programme
Trinity Terminal III (Phase 2) Extension, 2000 • Quay extension	Intertidal areas; waders and wild fowl and habitats; Stour and Orwell SPAs; water quality in estuary	Loss of intertidal areas; loss of feeding and roosting habitats; decrease in tidal range; combined impacts from lighting and combined impacts from noise on Trimley marshes p SPA	Hydrological modelling; use of findings from previous studies; professional judgement and consultation	Benefit of 13.7 ha within estuary system; enhancement of 23 ha; loss of 4.6 ha within SPA	Qualitative and quantitative assessment on hydrology and estuarine environment; considered effects of past, present and future projects within or adjacent to the estuaries; 'appropriate assessment' study

(continued on next page)

Table 3 (*continued*)

Projects	VECs	Issues/impacts	Approaches	Mitigation measures	Determination of significance	Comments
Proposed New Quays in Cliff Quay, Ipswich, 2000 • New quay	Intertidal habitats—Stour and Orwell Estuaries SPA, Ramsar and SSSI	Loss of intertidal areas; increase in rate of intertidal erosion	Hydrological modelling; expert judgement and; use of findings from previous studies	Relocation of dredged material within estuary system	Effects insignificant	Qualitative and quantitative assessment on hydrology and intertidal area; considered effects of past, present and future projects within or adjacent to the estuary; 'appropriate assessment' study
Flood Defences Improvement, 2000 • Southend on Sea Improvement of sea defences	SPA/Ramsar sites	Habitat loss; disturbance to birds	Professional judgement		Combined effects not significant over the effects of sea defences	Qualitative assessment; considered other future projects in study area; 'appropriate assessment' study

that identified cumulative or combined effects, and only 9 (18%) EISs provided an analysis, some of which considered cumulative effects on all affected resources (CTRL and M2 widening EISs, Swale Gateway, Ebbsfleet and Otterburn). Three EISs (Trinity III Terminal Extension, Proposed New Quays, Ipswich and Flood Defences Improvement, Southend on Sea) considered cumulative effects on a designated site SPA. The Wharrels Hill Wind Farm focused on landscape character and visual amenity. Those EIAs that considered all affected resources presented a more balanced assessment while those that focused on a particular resource provided a more detailed assessment of cumulative effects on that resource. For instance, the Trinity III Terminal EIS focused on the following hydrodynamic effects: a change in the tidal range; increased accretion in the harbour; and the loss of intertidal areas. Cumulative impact modelling was undertaken for relevant projects in the Stour and Orwell Estuaries where it was considered that the impacts of each of the schemes would be large. For schemes with smaller predicted hydrodynamic impacts, the estimate provided by summing the separate impacts of the schemes were considered adequate for the EIA.

Important cause-and-effect relationships were identified in the Proposed New Quays at Ipswich EIS, where the loss of the intertidal area could cause displacement of birds. Likewise, cause–effect analysis was used in considering potential successive impacts on receptors (e.g. fauna and flora, soil, water quality) and to examine more closely indirect causes and effects of the primary impacts in the Stonecastle Farm Quarry EIS.

However, out of the 15 EISs that identified potential cumulative effects, four (8%) EISs concluded without analysis that these effects were not significant. Uncertainty in impact assessment was mentioned in nine (18%) EISs, while risk was mentioned in seven (14%) EISs. Transboundary/global issues were mentioned in only one EIS, which was a proposal for a wind turbine. This EIS (Somerton Wind Farm) referred to the positive effect on air quality that the proposal would bring.

3.5. CEA methods

The methods used to identify cumulative effects included: professional judgement, matrices and consultations. In the Westhay Heath EIS, a scoping matrix was used to identify potential cumulative effects arising from the projects' activities and as a guide to the key areas that required further analysis.

Cumulative effects were described qualitatively in 13 (26%) EISs although noise impacts were quantified in the combined assessment of two EISs (CTRL and M2 widening). In the Trinity III Port Extension and the Proposed New Quays, losses of intertidal areas were also quantified.

Modelling (hydrodynamic) was used to predict and quantify impacts in two EISs (Trinity III Port Extension and Proposed New Quays at Ipswich). The Wharrels Wind Farm EIS used Zones of Visual Analysis plans to assess

cumulative visual impacts. In addition, public consultations were conducted during an exhibition attended by 250 people. Comments were sought on the findings of the EA, including visibility maps and photomontages showing the appearance of the wind farm from a number of vantage points. These comments were taken into account in the wind farm design and visitor facility proposal.

As far as guidance is concerned, a few EISs mentioned the lack of guidance on CEA. One EIS mentioned using guidance from the US CEQ, and another mentioned seeking guidance from the Institute of Environmental Assessment. Only one EIS referred to the EC Guidance. Table 3 shows the EIAs that provided some analysis of cumulative effects.

3.6. Evaluation of significance

The criteria used for determining significance of impacts in general were described in 42 (84%) EISs. In most cases, the criteria described in the DOE's Guidance on the Preparation of Environmental Statements (DOE, 1995) were followed in evaluating significance of effects. The nine EISs that provided an analysis of cumulative effects also evaluated the significance of these effects. The means of evaluating significance were based on the following criteria: impact magnitude, spatial extent, duration and frequency. For example, the sum of the combined effects of projects on individual species was used in determining the significance of combined effects in the Flood Defences Improvement EIS. In the CTRL and M2 Combined Assessment, the significance of an accumulation of noise effects from construction and off-site rail and road movements on a residential area was assessed based on an aggregation of noise impact calculations. Another example illustrates how the significance of visual effects was established. The magnitude of impact was correlated with the sensitivity of the receptors (residents, walkers, workers who were graded high, medium or low depending on proximity and activity) (Wharrels Wind Farm EIS).

3.7. Mitigation, monitoring and management of effects

The mitigation measures proposed in most of the EISs were for the direct impacts of the project. Mitigation measures for cumulative effects were proposed in only four EISs. For example, the CTRL and M2 widening combined assessment proposed the following mitigation measures to reduce cumulative impacts: For the combined community effects on local vehicle travellers, mitigation of impacts consisted of implementing appropriate controls on movements of construction traffic from both schemes, and for combined ecological effects, compensation for loss of habitats were provided by proposals for opportunities for habitat development. In the Trinity III Terminal Extension EIS, one of the mitigation measures proposed was the creation of

habitat at Trimley Marsh to compensate for the reduction in intertidal exposure associated with the channel deepening and the terminal extension. However, as indicated in the EIS, it is difficult to predict the cumulative loss of intertidal area within the estuaries because the outcome of the sediment replacement, habitat creation and beneficial use schemes considered are still to be determined and the implementation of the future schemes is not certain. In addition, as pointed out in the EIS, the analysis of the effectiveness of mitigation measures does not include the mitigation measures of other project proposals in the estuary (the Proposed New Quays at Ipswich and Bathside Bay Reclamation).

The effectiveness of the mitigation measures were indicated in 20 (40%) EISs, but these referred to impacts in general and not specific to cumula tive effects. Residual impacts after mitigation were mentioned in 47 (94%) EISs.

Monitoring proposals were mentioned for some impacts, such as impacts on air, noise or water resources but not for cumulative effects in particular. Only 27 (54%) EISs mentioned monitoring and 12 (24%) EISs indicated that the results of the monitoring programme will be incorporated into the project operations. Management plans to mitigate impacts were proposed in 34 (68%) EISs, but these were for impacts in general and not the long-term management of cumulative effects.

Table 4
Pairs of project EIAs

Projects	Cumulative effects considerations
1. Thameside Energy Park CHP Plant and Energy Distribution System and Natural Gas Pipeline to Energy Park	Pipeline EIS mentioned cumulative effects but no assessment
2. Kingsnorth Integrated Waste Management Facility and Kingsnorth Integrated Waste Management Facility Residue Disposal Site	Both EISs mentioned cumulative effects but no assessment
3. Kings Cross Railways Bills 1 and 2	Both EISs mentioned cumulative effects but no assessment
4. CTRL and M2 (junctions 1–4) widening	A combined effects assessment annex for both projects
5. Ebbsfleet Development and South Thameside Development Route (STDR)	Ebbsfleet Development EIS provided analysis but STDR EIS did not mention cumulative effects
6. Stockmoor Village and Willstock New Village	No mention of cumulative effects
7. Trinity III Terminal (Phase 2) Expansion and Proposed New Quays at Cliff Quay, Ipswich	Both conducted cumulative effects assessments
8. Heathrow Terminal 5 and Heathrow Express Underground (HEU)	Although HEU EIS referred to the Heathrow Terminal 5 EIS, there was no analysis of cumulative effects

3.8. Results of subsamples

In the subsample of eight EISs of urban regeneration projects, only two EISs considered cumulative effects. This may suggest that cumulative effects are not considered adequately in this sector and follows findings from previous studies that the quality of urban development EISs are less satisfactory than other types of projects (Lee and Dancy, 1993), but the sample is too small to allow any concrete conclusions.

In the subsample of 14 EISs in the Thames Gateway, six (42%) EISs considered cumulative effects, but two of these were the CTRL and the M2 widening, which produced a combined assessment. Although the percentage of EISs that considered cumulative effects in this region is higher than the percentage for the whole sample, the sample is not large enough to allow any generalisation.

In the subsample of eight pairs of EISs, there were only two pairs of EISs that both conducted an assessment of cumulative effects: CTRL and M2 widening and the Trinity III Terminal Extension and Proposed New Quay at Ipswich. In another pair of EISs, one EIS (Ebbsfleet Development) identified potential cumulative effects though another project identified in that EIS (the South Thameside Development Route (STDR)) did not mention cumulative effects in its EIS. In other pairs of EISs, cumulative effects with reference to the other projects were mentioned (Thameside Energy Park and Gas line; Kingsnorth IWMF and Landfill; Kings Cross Bills 1 and 2). Where an existing plan or framework, such as transport plans, are already in place, other projects are then mentioned in the impact study. However, although the Willstock and Stockmore EISs considered each other in terms of studies of transport and hydrology in the area, cumulative effects were not specifically mentioned in the EISs. Table 4 shows cumulative effects considerations in the paired EIAs.

4. Discussion

The results of this review reveal that EISs in the UK continue to fail to address cumulative effects issues adequately. Only 24 of 50 EIAs (48%) mentioned cumulative effects, and most of these EIAs failed to address cumulative effects thoroughly. Ten EISs that mentioned cumulative effects in the introduction did not consider or refer to cumulative effects subsequently. Out of the 15 EISs that identified cumulative effects, only nine EISs provided some analysis. The systematic consideration and assessment of cumulative effects was found only in three EISs, the combined assessment (CTRL and M2 widening), which considered the combined effects of the two projects, and the Otterburn EIS and Swale Gateway EIS, which considered the cumulative effects of the developments within their schemes.

Some findings from this survey are supported by those from previous reviews of EAs in the US. A review of 89 EAs by McCold and Holman (1995) revealed that 35 EAs (39%) mentioned cumulative impacts, and in a review of 30 EAs by Burris and Canter (1997), 14 EAs (47%) used the term cumulative impacts. Similarly, findings from reviews of Canadian CEA reports (Baxter et al., 1999; Mendoza Duran et al., 2000) reveal that the standard of CEAs undertaken is unsatisfactory.

Of particular concern in this survey is the varied interpretation of what is meant by cumulative effects. One reason for this may be because neither the EC Directive nor the UK Regulations provide a definition of cumulative effects. In this sample alone, out of 24 EISs that mentioned cumulative effects, there were eight different definitions provided. In addition, other EISs referred indirectly to cumulative effects as combined effects, in-combination effects and interaction effects. From the survey, the definition of cumulative effects adopted in the EIA determined the scope of the assessment. A narrower definition, such as that of interaction of impacts within the project resulted in the analysis of the cumulative impacts of the project alone, while a wider definition, which included other projects (past, present and future), led to a broader geographical and temporal scope.

The relationship between the EIA requirement for the assessment of cumulative effects and requirement for the assessment of in-combination effects under the Habitats Directive needs to be clarified. Some EISs (e.g. Trinity 111 Terminal Port Extension and the Proposed New Quays at Ipswich EISs) have suggested that the CEA in the EIA could provide the information necessary for the 'appropriate assessment' by the competent authority as required under the Habitats Directive. The findings from this study reveal that most of the EISs that considered cumulative effects were adjacent to or near statutory designated sites, such as European Sites. Out of the eight EISs that provided an analysis of cumulative effects, three EISs were prepared as part of the appropriate assessment for the Habitats Directive (Trinity III Terminal Extension, Proposed New Quays at Ipswich and the Flood Defences Improvement at Southend on Sea). The review revealed that the assessments of cumulative effects in the first two EISs were more detailed than the analysis undertaken by the other EISs in the sample. This may be because of the added protection afforded statutory designations, more specific guidance relating to the Habitats Directive and/or more concern about these affected resources (birds) by environmental organisations. A deficiency that was observed in the survey was the inadequate attention to defining the temporal and spatial boundaries for the study and to identifying other existing and proposed projects in the area. The geographical boundary for most EISs was the immediate area surrounding the project, rather than a broader regional context that might be more appropriate for some of the larger-scale developments. This limited spatial boundary precludes the determination of other existing and planned projects and impacts, which when considered with the impacts of the project, could be cumulative. Information

provided by most EISs on other developments was limited, so that their potential additional stress on the affected resource could not be determined. Apart from three EISs (Ebbsfleet Development, Trinity III Terminal Extension and Proposed New Quays, Ipswich) there was a failure to take adequate account of other past, present and future developments. This is particularly true regarding future developments. This failure to take account of likely future developments may be due to the lack of specific requirements and guidance on what developments to include. Existing developments were taken into account mostly in the traffic assessments of EISs, which followed the procedure in the guidance (Design Manual for Roads and Bridges, vol. 11, Department of Transport et al., 1993). As far as temporal considerations are concerned, these were limited in most cases to the construction and start of operation of the project. One difficulty in assessing cumulative effects, as pointed out in the Trinity III Terminal Extension EIS, is that while a regional CEA might be a more appropriate level for assessing cumulative effects (such as for an estuary where many developments are being proposed), this type of assessment may be beyond the scope of a project EIA.

Where an existing plan or framework is available, these have been used to set the context for the EIAs. For example, cumulative impact studies in the Stour and Orwell Estuary have been used in addressing cumulative effects in two EISs (Trinity III Terminal Extension and proposed New Quays, Ipswich). However, some EISs do not always make use of such frameworks to assess the relative contribution of the proposed project. For example, Kent County Council has developed an air quality model that includes estimates of all major sources of pollution and is regularly updated. The model was used by two EISs for two project proposals in this area (Kingsnorth IWMF and Ridham Dock) in identifying other potential sources of pollution in the region, it but did not continue the analysis to address cumulative effects. In another example, the Bridgwater Transport Study provided the context for the assessment of transport impacts of two proposed housing developments (Willstock and Stockmoor). The hydrological study for the area was also used in both the Willstock and Stockmoor villages EISs, but the cumulative effects of both projects were not addressed. It seems that the difference between these EIAs and that of the Trinity III Terminal Extension and Proposed New Quays EISs (which conducted CEAs) is the strong emphasis placed on the assessment of combined effects or CEA during scoping and consultations in these EIAs, as revealed in the EISs. Comments from statutory consultees (such as the Ministry of Agriculture, Fisheries and Food, Suffolk County Council, Royal Society for the Protection of Birds, English Nature) in the Trinity III Terminal Extension EIS stress the need for cumulative effects to be assessed. As stated in the Proposed New Quay EISs, the aim of the CEA was to supply information to allow the competent authority to determine whether the proposed development is likely to have a significant effect on the Stour and Orwell Estuaries SPA as required by the Habitats Directive.

The findings of the study reveal that cumulative effects were mentioned more frequently in recent EISs, but the EISs that actually discussed or analysed those effects were not related to when the EISs were prepared. Furthermore, the consideration of cumulative effects was not related either to the type of development or geographic location, except when it was adjacent to a protected site. It seems, from this study at least, that CEA is facilitated by two factors: (1) when the projects are part of a development or programme by a single proponent (such as the Otterburn and the Swale Gateway EISs) or (2) when similar projects in the area under consideration are being assessed (Trinity III Terminal Extension and the Proposed New Quays at Ipswich EISs).

5. Conclusions

This survey shows an uneven and inconsistent treatment of cumulative effects in the EISs reviewed and highlights the limitations of project EIAs in addressing cumulative effects. Some of the constraints to CEA recognised in some of the EISs themselves were the uncertainty in regulatory requirements, lack of guidance and access to information on other relevant developments. It is worth noting, however, that in EIAs where the scoping stage considered cumulative effects, these effects were subsequently identified and discussed. This suggests that scoping can play a significant role in ensuring that cumulative effects are considered in EIAs. But more importantly, for cumulative effects considerations in EIAs to improve, these effects should be given equal weight with other factors in the decision-making process.

The Amendment Directive 97/11/EC now provides a clearer opportunity (though not mandatory) for scoping within the EIA process, whereby developers are encouraged to consult with the competent authority and obtain a scoping decision.[3] The most effective driving force for better consideration of cumulative effects is therefore likely to be the local planning authority (and other competent authorities) encouraging developers through better scoping to meet the most recent requirements of the legislation to address cumulative effects. Past arguments that developers were not required to provide information on cumulative effects will no longer be a legitimate excuse now the Amendment Directive 97/11/EC and the UK Regulations have strengthened cumulative effects more on a par with other impacts (Schedule 4 of the 1999 Regulations). This, in turn, requires a greater awareness of CEA by local planning authority planners and a better understanding of cumulative effects and methodologies for how such effects can be addressed. More tailored guidance for developers and authorities alike is needed for this to happen.

[3] Regulation 10, Town and Country Planning (Environmental Impact Assessment) Regulations 1999 (England and Wales).

Appendix A. EISs reviewed in the survey

ES no.	Title of EIS	Date submitted	Project type
1	South Lowestoft Relief Road	1999	Road
2	Birmington-Staveley By-pass	1995	Road
3	A 142 Fordham By-pass	2000	Road
4	Immingham Combined Heat and Power Plant	Nov 2000	Power station
5	Thameside Energy Park CHP Plant and Energy Distribution System	Feb 2000	Power station
6	Natural Gas Pipeline to Thames Energy Park	Dec 1999	Gas pipeline
7	Ridham Dock Integrated Waste Management Facility	May 1999	Waste to energy facility
8	Belvedere Refuse to Energy Project	April 1991	Waste to energy facility
9	Kingsnorth Integrated Waste Management Facility	Oct 1996	Waste to energy facility
10	Kingsnorth Integrated Waste Management Facility Residue Disposal Site	Oct 1996	Landfill site
11	Norton marsh: Proposed Extension to Arpley Landfill	Oct 2000	Landfill site
12	Flood Defences Improvement—Southend on Sea	2000	Flood defence
13	Isle of Grain Propose Drainage	Dec 2000	Land drainage
14	Westhay Heath Peat Extraction	July 2000	Peat extraction
15	Potton Pool Quarry	July 2000	Sand and gravel quarry
16	Woodhead Open Cast Coal Extension	June 2000	Open cast mine
17	Stonecastle Farm Quarry	May 2000	Quarry extension
18	Medway Cement Works	1997	Cement plant and quarry
19	Havering Riverside	1997	Commercial/ industrial
20	Multiplex cinema, Health and Fitness Centre and Food Outlet—Barnstaple, Devon	Aug 2000	Mixed use development
21	Park Royal Southern Gateway	Feb 2000	Mixed use development
22	East Manchester District Centre	Aug 2000	Mixed use development
23	Chavasse Park—Liverpool	Feb 2000	Mixed use development
24	Rochdale—Greater Manchester	Aug 2000	Mixed use development

25	Broomsgrove—Hastings	Aug 2000	Mixed use development
26	Redevelopment of Taylor Woodrow site	Aug 2000	Mixed use development
27	Earlsgate—Swindon	Sept 2000	Residential settlement
28	Woodville Woodlands—Leicester	Dec 2000	Residential settlement
29	The Swale Gateway Development	Feb 1994	Industrial/ commercial and residential schemes
30	Stockmoor Village	Nov 2000	Residential
31	Willstock New Village	May 2000	Residential
32	Kings Cross Railways Bill Nos. 1 and 2	May 1991	Railway terminal improvements
33	Jubilee Line Extension	March 1990	Underground railway
34	CTRL	1994	Rail link
35	M2-Junctions 1 4 widening	Nov 1994	Motorway widening
36	Ebbsfleet Development	Dec 1995	Railway station and mixed use development
37	South Thameside Development Route	Oct 1995	Road
38	London City Airport	Dec 1989	Runway extension
39	Terminal 5—Heathrow Airport	1993	New terminal
40	Heathrow Express Extension	Sept 1994	Underground railway
41	Manchester Airport 2nd Runway	1993	New runway
42	Gravesend Wastewater Treatment Works	Dec 1996	Wastewater treatment plant improvements
43	Motney Hill Wastewater Treatment Works	Sept 1994	Wastewater treatment plant improvements
44	Wharrels Hill Wind Farm	Dec 2000	Wind farm
45	Somerton Wind Turbine	1998	Wind farm
46	Testwood Lakes	July 1991	Reservoir and mineral extraction
47	Otterburn Training Area	April 1995	Army field training centre
48	Trinity III Terminal (Phase 2) Extension	Oct 2000	Port extension: new quay
49	Propose New Quays at Former Power Station Site—Cliff Quay, Ipswich	Sept 2000	New quays
50	South Ipswich Brownfield Regeneration and Improved Access to Port	Dec 2000	Mixed use and linked road

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Cumulative impacts

Integrating cumulative effects assessment into UK strategic planning: implications of the European Union SEA Directive

Lourdes M Cooper and William R Sheate

This paper considers several options for addressing cumulative effects in strategic planning, one of which is through strategic environmental assessment (SEA). The adoption of the EU Directive on the assessment of effects of certain plans and programmes on the environment and its future incorporation into UK law by 2004 will have implications for the consideration of cumulative effects in strategic planning. An interview survey of 28 government regulators, experts, practitioners and planners revealed current understanding of cumulative effects, what cumulative effects issues could be addressed at the various planning levels and how they may be addressed through SEA. The findings helped inform the development of a framework for integrating cumulative effects assessment into the SEA and plan-making process. The proposed framework identifies key steps and activities in the SEA process to address cumulative effects.

Keywords: cumulative effects assessment; strategic planning; strategic environmental assessment; sustainability appraisal; SEA Directive

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THE ASSESSMENT OF cumulative effects is now required by four European Community (EC) Directives: two directives refer to project environmental impact assessments (EIAs) (CEC, 1985; 1997) and two require the assessment of these effects at strategic levels (CEC, 1992; 2001). The assessment of cumulative impacts or effects of certain public and private projects has been required in the European Union since the EC Directive (85/337/EEC) on environmental impact assessment was issued (CEC, 1985). Cumulative effects are referred to in Annex III of the Directive in which the description of the likely significant effects of the proposed project on the environment should include cumulative effects.

The Directive was originally implemented in the UK under the Town and Country Planning (Assessment of Environmental Effects) Regulations 1988 (SI 1988 No 1199), which refer to cumulative effects in Schedule 3 as optional information to be included in the environmental statement.

The Amendment Directive 97/11/EC (CEC, 1997), which became effective in 1999, amending Directive 85/337/EEC, makes a further reference to cumulative impacts. This Directive states that, in the criteria for selecting projects to be assessed, the characteristics of projects must be considered having regard to the "cumulation with other projects" and the environmental sensitivity of areas likely to be affected (CEC, 1997, Annex III).

This Directive is implemented in the UK through the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations

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1999, SI 1999 No 293 with the provisions also referring to the "cumulation with other projects" in the Selection Criteria for Screening Schedule 2 developments (those that may require EIA). These regulations list cumulative effects alongside direct and indirect effects in the main text of Schedule 4 (Part I), which is potentially much stronger than the 1988 regulations where information on cumulative effects was entirely optional for the developer.

Other legislation that requires the consideration of cumulative effects at both the project and plan levels is the EC Habitats Directive 92/43/EEC (CEC, 1992). This Directive requires that an "appropriate assessment" should be conducted when a plan or project is likely to have a significant effect on the site (special area of conservation) either individually or in combination with other plans or projects (CEC, 1992, Article 6).

The Directive is implemented in the UK as the *Conservation (Natural Habitats etc) Regulations* (DOE, 1994). The regulations propose that "appropriate assessment" should be carried out by a competent authority before authorising "a plan or project which is likely to have a significant effect on a European site in Great Britain (either alone or in combination with other plans or projects)" (DOE, 1994a, page 26). A 'European site' in this context refers to a special area of conservation (SAC), a site of Community importance or a designated special protection area (SPA) for birds.

A more recent piece of legislation that provides an opportunity for the assessment of cumulative effects at strategic levels is the Strategic Environment Assessment (SEA) Directive 2001/42/EC (CEC, 2001) on the assessment of the effects of certain plans and programmes on the environment. This Directive was adopted on the 27th of June 2001, with member states having until 21st July 2004 to transpose it into national law. The SEA Directive requires the consideration of: "the likely significant effects ... including cumulative and synergistic effects on the environment ..." (Annex 1).

This paper initially discusses the concept of cumulative effects assessment (CEA) as applied at strategic levels, the linkages between CEA and SEA, the current practice of CEA in the UK and opportunities for improving cumulative effects considerations. The options for incorporating CEA at strategic levels and the findings of a semi-structured interview survey with regulators, planners, experts and practitioners on their understanding of cumulative effects, cumulative effects issues, and options for addressing cumulative effects are presented. A framework for incorporating CEA in SEA is then discussed in detail.

Cumulative effects assessment

Cumulative effects assessment has been defined as the process of systematically analysing and assessing cumulative environmental change (Spaling, 1994). The concept of cumulative effects and the need for its assessment was integral to the EIA legislation introduced in various countries in the 1970s. Since then, two broad types of CEA have evolved: project-focused and planning-based. Most CEAs are conducted as part of a single project application for regulatory approval. The effects of a project are then the focus of the assessment, and CEA in this context considers the effects due to that project and other projects.

Hence, the role of CEA in project EIAs is to extend the temporal and spatial boundaries of the assessment and set the assessment within the context of the wider area or region. An extension of project-focused CEA may be the assessment of the cumulative effects of a cluster of projects, for example, wind farms on adjacent sites or a number of commercial developments within an urban regeneration area.

There are benefits to conducting CEA at project level. Baxter *et al* (2000) point out that project EIAs can address cumulative effects at the level of decision-making through project approvals and can reduce incremental contribution to cumulative effects. In addition, because of their scale, project EIAs can provide detailed, scientific analysis of impacts. However, a planning approach takes a more normative line (Spaling and Smit, 1993).

There are, though, benefits in undertaking both project-specific and planning-based CEAs. A planning approach to CEA can provide the regional context for assessing the cumulative significance of activities in the area and can assess the cumulative effects from gradual, piecemeal environmental change caused by a number of individually small projects (which may not be subject to EIA). In some cases, where a number of developments have been proposed in a geographical area, cumulative effects studies are used as part of regional planning and are initiated by public agencies, since EIA legislation referring to cumulative effects normally relates to projects and not to regions.

There have been a number of cumulative effects studies in Canada, such as the Banff-Bow Valley study and the Oak Ridges Moraine Planning study, that investigated the cumulative effects of activities on the environmental capacity of the region (Hegmann *et al*, 1999). Spaling *et al* (2000) note, however, that those undertaking such studies seldom have the authority to implement their recommendations and manage cumulative effects.

There are other initiatives that link CEA with a cumulative effects management system for the region. For example, the Cumulative Environmental Management Association in Alberta, Canada, developed a framework for CEA that provides a common understanding of CEA and management among the different stakeholders (Spaling *et al*, 2000). A similar approach is the regional cumulative environmental assessment and management framework in the Northwest Territories, Canada, which was initiated to provide regional context for land-use

planning and resource-management decision making (NWT CEAM Working Group, 2000).

In the UK, an example of a regional CEA is at Liverpool Bay. This was commissioned by the Countryside Council for Wales to develop a methodology for assessing cumulative effects of offshore industries from a nature conservation and landscape/seascape perspective as an aid to strategic planning (Oakwood Environmental Ltd, 2002).

Current practice of CEA in the UK

The consideration of cumulative effects has been required for project EIAs since 1988 in the UK, but researchers have noted how rarely it was undertaken (Glasson *et al*, 1995; Fuller and Sadler, 1999; Byron *et al*, 2000). Although attention to the consideration of cumulative effects in project EIAs has improved slightly since the 1999 regulations, the level of assessment continues to be low (Cooper and Sheate, 2002).

Since the concept of cumulative effects is not clearly defined in legislation, there is uncertainty among practitioners as to what cumulative effects mean and what to assess. There are other problems in addressing cumulative effects in project EIAs in the UK: the lack of guidance, difficulty in acquiring information regarding other projects, resource and skill shortages and uncertainty about where the responsibilities for CEA should be (Piper, 2001).

Some of these problems are common in project EIAs. Project EIAs have limitations in addressing cumulative effects, such as the time and space frameworks and the process within which they operate (Fuller and Sadler, 1999). Some authors regard CEA as part of regional planning and have suggested that cumulative effects assessment can be effective only within the context of strategic regional planning, which provides the necessary framework (Hubbard, 1990; Colnett, 1991; Damman, 2002).

Importance of a strategic approach to CEA

There are several reasons why cumulative effects need to be considered at strategic levels. First, cumulative effects can occur at different scales (sub-regional, regional, national and transboundary). Project-level CEA does not effectively address the concern of gradual environmental degradation from a range of activities and multiple stresses, and the interaction of multiple projects, programme and policy decisions (Spaling and Smit, 1993, Fuller and Sadler, 1999).

Some authors regard CEA as part of regional planning and have suggested that cumulative effects assessment can be effective only within the context of strategic regional planning, which provides the necessary framework

Second, strategic planning authorities are in a better position than the proponent to address cumulative effects. A proponent's ability to identify, quantify and evaluate the effects of other projects and activities may be severely limited by the availability of information and resources (Davey *et al*, 2002). As Kennett (2002) argues, the measures required to address those issues are not within the proponent's control. He suggests a government-driven approach to CEA with the government providing the baseline data and analysis required for CEA and dealing with issues relating to mitigation, monitoring and management.

Third, cumulative effects mitigation requires a broader approach than project-based assessment and monitoring (Baxter *et al*, 2000; Creasey, 2002) and the necessity for multiple agency involvement (Canter, 2000). As Davey *et al* (2002) note, the extent to which a proponent is responsible for managing cumulative effects is unclear and they suggest that a SEA would provide a suitable framework for making decisions on such matters and assist in identifying decision-making and management roles and responsibilities.

Fourth, a strategic approach to CEA can be more proactive in identifying and minimising the potential for cumulative effects as these effects can be addressed earlier in the planning process.

However, there are some constraints to regional CEA, such as increased uncertainty and difficulty in predicting the results of actions (Baxter *et al*, 2000). Furthermore, Creasey (2002) notes that there are obstacles to the broad consideration of CEA, such as the sectoral approach to regulatory approvals, the view that the CEA must be considered within the confines of project-based assessment law and policy, and there are few countries that have adopted an approach that moves away from individual project impact assessment to a regional or strategic approach.

There are countries and jurisdictions that have adopted strategic approaches to EIA, such as Canada, New Zealand, South Africa, the European Union through SEA, and the USA through programmatic EIAs. In Canada, the Cabinet Directive on Strategic Environmental Assessment was adopted to incorporate environmental considerations into the development of public policies.

Through SEA, environmental considerations can be addressed at the earliest appropriate stage of planning (CEAA, 2000). The EU SEA Directive requires that certain plans and programmes (though not policies) undergo SEA, which will provide an opportunity for the consideration of cumulative effects in the planning process in the UK.

Integrating CEA into strategic planning

As discussed above, project EIAs have limitations in addressing cumulative effects and these effects could be better addressed through strategic planning. In this context, the views of experts and practitioners were sought on how to improve the practice of CEA in the UK. Semi-structured interviews were carried out to establish current understanding of cumulative effects and determine how CEA could be integrated into the strategic planning process.

Twenty-eight interviewees were selected on the basis of their interest in the EIA and planning processes. These included government regulators (at national and regional levels), planners, statutory environmental consultees (including the Environment Agency and English Nature), regional development agencies and the Government Office for the South-east [of England], environmental NGOs (non-governmental organisations) (national and those operating in Southeast England), academics, EIA consultants involved in SEA and sustainability appraisal (SA), and urban regeneration partnership administrators.

Since the focus of the current research activity by the authors is the cumulative impacts of urban regeneration in the Thames Gateway[1] (a major area of regeneration to the east of London), most of those interviewed (18) were from the Southeast of England region. The interviews were undertaken from May 2002, before the draft guidance on SEA was issued by the UK Government (ODPM, 2002). At that time, discussions were still being conducted on how to incorporate the requirements of the Directive into the existing sustainability appraisal process operating at regional planning levels (Smith and Sheate, 2001).

The interview schedule consisted of two parts: the concept of cumulative effects and the role of CEA in planning; and approaches for considering cumulative effects in UK strategic planning. Examples of the key interview questions asked are shown in Box 1.

Box 1. Examples of key interview questions

How would you define cumulative effects?

Could you give some examples of cumulative effects?

What cumulative effects issues can be addressed at different geographical scales?

To what extent can cumulative effects assessment (CEA) assist in planning and decision making?

What would be an appropriate planning level for CEA?

Which of the four options presented for integrating CEA into planning would be most feasible or desirable? (*see options below*)

What features should a CEA framework have that would make it useful for planning?

What are the constraints to integrating CEA into strategic planning?

Understanding of cumulative effects

The level of understanding of what cumulative effects are and how they can be assessed were variable. The criteria used for measuring the level of understanding were based on the definition and examples of cumulative effects provided by the interviewees. Definitions were classified into three levels. Level one consisted of no understanding of the concept or uncertainty about what cumulative effects meant. Level two showed rudimentary understanding (for instance, total or sum of effects). Level three demonstrated some understanding of the more complex characteristics (synergistic or compounding) effects.

Some interviewees, such as government regulators, urban regeneration partnership administrators and, surprisingly, environmental partnership organisations had a lower understanding of cumulative effects than planners, environmental NGO officers and consultants. Yet, even among these, there was no consensus on what cumulative effects mean. This suggests a lack of clear or common understanding of the concept among those involved in the EIA process. These findings confirm the results of a survey of 50 UK EIAs, which came up with eight different interpretations of cumulative effects (Cooper and Sheate, 2002). The main definitions of cumulative effects from the current interviews were:

- The total effects on the whole system or overall impacts.
- Impacts by the action elsewhere or on others.
- Interaction of impacts and policies.

Comparing the types of cumulative effects identified by the interviewees with a typology adapted from Spaling (1994) further illustrates the disparate understanding of the term among practitioners and regulators. Spaling (1994) groups the effects into two categorises: functional (time crowding, time lags); and structural (space crowding, cross boundary, fragmentation). He states that other types of cumulative effects, such as compounding, indirect and thresholds are indicative of the manner of accumulation.

Most of the interviewees defined cumulative effects as the 'sum of impacts' while fewer characterised them as 'synergistic' or 'compounding'. The majority of the interviewees' understanding of cumulative effects is that they are primarily additive in nature. There is less understanding of the more complex characteristics of these effects, such as their compounding or synergistic ways of accumulating. For example, Barrow (1997) lists other types of cumulative effects including "surprise effects" and "impacts from feedback processes" which were not referred to. Some interviewees commented that cumulative effects cover a lot of meanings and they are

Most interviewees' understanding of cumulative effects is that they are primarily additive in nature: there is less understanding of the more complex characteristics of these effects, such as their compounding or synergistic ways of accumulating

complex in nature. There were some interviewees who were unsure.

The types of cumulative effects identified in the interview survey are shown in Table 1. Also included are the types of cumulative effects identified from 50 UK EIAs reviewed by Cooper and Sheate (2002), in order to compare the findings from the interviews with EIA practice. This shows that in those project EIAs, the concept of cumulative effects was limited to project-related effects and did not include so-called 'nibbling' effects.

Cumulative effects issues in the Thames Gateway

The interviewees were asked to give examples of cumulative effects. Those who had some interest or responsibility in the Thames Gateway were asked for examples of cumulative effects issues in this area of intensive urban regeneration; these were discussed in terms of the stressors or causes in the area and the pathways of these impacts. The main stressors identified were housing development and transport infrastructure provision. The main cumulative effects issues identified and the number of interviewees who referred to them were: traffic and transport (13); air pollution (11); flooding (11); water resources (9); biodiversity/habitat loss (9); open spaces (6); waste (4); and impact on utilities and services (7). Table 2 shows the types of cumulative effect issues and causes identified.

Role of CEA in planning and decision-making

When asked to what extent CEA can assist planning and decision-making, all the interviewees except one were positive that CEA can make a useful contribution to strategic planning. Some of the responses and the number of interviewees who provided those statements are that CEA can:

- be used to assess overall effects (5);
- inform policy (5);
- inform decision-makers so that they can reach better decisions (7);
- inform choices (such as allocation of sites and land use) (6);
- assist in management and mitigation at plan level (4);
- help planning to be more proactive and direct the process (6).
- Other comments included that it can help understand cause–effect relationships and impact links, and assist long-term planning and transparency in the process.

One interviewee stated that cumulative effects are already taken account of in the planning process; another commented that there is already an assumption that these matters are considered in policy direction. However, another planner observed that the planning system is designed to be holistic, but it is weak on incremental losses so that gradual degradation, for example, is missed and not considered in

Table 1. Types of cumulative effects identified in the interview survey and EIAs

Typology of cumulative effects	Cumulative effects types and characteristics identified in survey and no. of interviewees who referred to such effects		Cumulative effects identified in review of EIAs (Cooper and Sheate, 2002)
Incremental (additive) (repeated actions of a similar nature) - time crowding - space crowding	effects of additional impacts over time	(15)	*
Time lags or delayed effects	effects over time	(5)	
Cross-boundary movement	impacts occur elsewhere	(3)	
Fragmentation	fragmentation of habitats	(3)	*
Compounding/ synergistic effects	effects from multiple causes & processes interaction of impacts & policies	(7) (2)	*
Indirect effects; secondary or higher order effects	indirect and secondary impacts	(2)	*
Nibbling effects	lots of small impacts	(5)	
Triggers and thresholds	thresholds reached due to impacts	(3)	

Source: Typology adapted from: Spaling (1994)

Table 2. Cumulative effects issues in the Thames Gateway

Cumulative effects issues	Causes
Increase in traffic and congestion	increase in transport movement and commuting
Increase in air pollution	greater use of private vehicles industrial releases of nitrogen oxides
Increase in flood risk	many new developments (housing) on, or close to, the floodplain increase in water run-off from built-up areas sea-level rise and climate change farming practices
Reduction in water supplies and groundwater contamination	many new developments (commercial and housing) in the area
Habitat loss and fragmentation	use of land for development and transport infrastructure
Loss of open spaces and disruption to network of green spaces	development on open spaces and brown-field sites
Loss of inter-tidal area; erosion of salt marshes	sea-level rise encroachment
Increase in waste production	increase in industrial, commercial and residential activities
Impact on water quality of estuary and rivers and on freshwater and marine habitats	increased activity on riverside
Increased demand for utilities (electricity), and services (schools, health and recreational facilities)	growth in population
Impact on urban environment (increase in noise)	traffic, construction activities
Impact on health	traffic, noise, air pollution
Positive impacts on environmental quality — improved public spaces, public transport, visual quality	urban regeneration programmes: redevelopment of derelict sites, improvement in design standards, provision of public transport, pedestrian & cycle lanes

planning applications. A systematic approach to addressing cumulative effects at a strategic level would therefore be useful in the ways suggested above as well as taking account of incremental losses that are missed in the CEA/EIA development control model.

Appropriate planning level for conducting CEA

The interviewees were asked what would be an appropriate strategic planning level for assessing cumulative effects. This was to identify where a CEA framework could be useful and capable of being implemented, considering the planning process at each of the following levels:

- regional planning process, through regional planning guidance or regional strategies (for instance, economic, transport, spatial);
- local planning process, through development plans or the newly proposed local development frameworks;[2]
- programme or master plan level (clusters of projects or an overall plan for an area of regeneration);
- integrated at all planning levels.

Half of those interviewed (14 out of 28 interviewees) preferred that CEA should be integrated at all levels of planning. The remainder were of the opinion that cumulative effects should be considered at one or more of the following levels: regional (3); local plan (5); and master plan/programme (2), while others were not sure. Among those that chose the last option, six stated that CEA at regional level would be vague and more difficult, and that it would be easier to assess cumulative effects at the plan or programme level.

One interviewee suggested that CEA could be used as a tool for determining housing distribution at the regional level. Then at the local or district plan level, CEA could be used to assess the distribution effect on services and utilities. She also suggested that CEA could be useful in assessing cumulative transport impacts and this could influence transport strategies at different levels.

Discussions were held as to what cumulative effects issues can be addressed at each planning level. Some interviewees suggested that cumulative impacts such as flooding and air quality should be addressed at regional or sub-regional levels, while more localised cumulative effects, such as noise and visual impacts, could be addressed at the local or sub-local plan (master plan or programme) level. Three interviewees suggested that cumulative impacts on open spaces should be dealt with at a strategic level because of the necessity of assessing the whole of the green spaces network.

Options for addressing cumulative effects

From the literature and current planning and assessment processes, four options or approaches for integrating CEA into the planning process were presented to interviewees:

- CEA integrated into sustainability appraisals of plans;
- CEA integrated into SEA of plans;

- a CEA framework for the plan area;
- strengthen CEA at project level by widening scope.

Most of those interviewed stated that CEA should be conducted within existing frameworks such as part of sustainability appraisals (8 or 28%) and SEAs (14 or 50%) and regional sustainability frameworks (1). However, one interviewee said that it might be difficult to incorporate CEA into sustainability appraisals because cumulative impacts of policies may not be *so easily assessed. Nobody chose a separate* CEA framework for the plan area because it was thought introducing a new process would not be practical. One interviewee preferred the option to strengthen CEA in project EIAs.

Features for CEA framework

Most interviewees (17) stated that a tiered approach to CEA would be useful: from policy, to plan and programmes. There were many suggestions as to what features a CEA framework should have to make it feasible. These features had to do with: approach; process; practicality; implementation; and information requirements. One planner suggested that guidelines on how to do a CEA would be useful, particularly with regard to finding information required for the assessment. He thought that a series of questions at each stage would be helpful as well as suggestions on "who to talk to" and "where to look up information". The same view was held by Damman *et al* (1995) who suggested that, for CEA to become normative in EIA and integrated into other decision-making processes, such as land-use planning, practical methodologies must be available to the practitioner. The features and the number of interviewees suggesting each element are shown in Table 3.

Constraints to CEA at strategic level

There were several constraint areas identified in implementing CEA at strategic levels: conceptual; administrative; technical difficulties; and information. Some of these are in common with project EIA CEAs, such as the lack of knowledge or concept of CEA. Piper (2001) identified barriers to the implementation of CEA, including some of the constraints identified in this interview survey. The focus of the interview question, however, was on integrating CEA at the strategic level. Some of the constraints identified in the interviews and the number of interviewees who referred to those are summarised in Table 4.

Cumulative effects assessment in SEA

SEA has been defined as a systematic process of addressing the environmental consequences of proposed policy, plans and programmes (Sadler, 1996). Cumulative effects assessment and SEA are closely linked. SEA has been promoted as a means of dealing with cumulative effects assessment (Barrow, 1997), and is seen as providing a context and rationale

Table 3. Features of CEA framework for plans

Features	No of interviewees
Approach	
Define what is meant by cumulative effects, cause–effect relationships and how to consider such effects	9 (32%)
Adopt a strategic/ecosystem approach	11 (39%)
Conduct CEA within wider appraisal processes, such as integrate into SEA	7
Focus or prioritise important issues or effects	11
Provide context/linkage with project EIAs	12 (43%)
Process	
Set objectives and specify at what point cumulative effects are considered in planning process. Consider early, at scoping stage of plan	9
Set boundaries broadly	4
Use state of environment reports and detailed information for the baseline	8
Use indicators, thresholds, benchmarks and trigger levels	9
Provide guidelines on establishing thresholds	2
Base assessment on sensitivity of affected resources and incorporate risk assessment approach	9
Define role of agencies involved and who undertakes the CEA	5
Define public involvement	3
Include monitoring and management	3
Provide guidelines on how to set criteria for significance	3
Focus on outcome: how the CEA process could be implemented, how to enforce it, how useful it is to the decision maker and how it would improve planning	5
Set quality standards	2
Use precautionary principle	4
General	
Should be practical, straightforward, in easily available form and use sensible criteria	9
Provide advice on information: how to access information; what to do with information	2

Table 4. Constraints to CEA at strategic level

Constraints	No of interviewees
CEA in general	
Conceptual: lack of knowledge and understanding of cumulative effects and CEA	13 (46%)
Lack of guidance on CEA	5
Technical difficulties at strategic level	
Lack of data or access to data, particularly on future developments	7
Difficulty in prediction, lack of models	7
Planning is territorial and based on administrative boundaries while effects could cross boundaries	2
More impacts to consider, such as gradual degradation, and so assessment more vague	4
Difficulty in proving causal link	2
Capacity and resources	
Planners' lack of time, knowledge and experience of CEA	5
Political will and source of funding required for the assessment	2
No policy/planning framework for CEA	3

within which to address cumulative effects that are not normally addressed on a project-by-project basis (Therivel and Partidario, 1996). Likewise, SEA facilitates a planning approach to addressing the cumulative effects of projects that occur as a result of decision-making processes (Bonnell and Storey, 2000). As Sadler (1996) stated, the analysis of cumulative effects is facilitated by SEA by permitting an early, overall look at potential relationships and impacts, and the scope of SEA is more appropriate to the time and spatial scales at which cumulative effects occur. Fuller and Sadler (1999) suggested that SEA is a more promising approach to cumulative effects than the project EIA model.

Another possible role for SEA is to support the subsequent assessment of cumulative effects of projects (Davey *et al*, 2002). On the other hand, if SEA is to be effective in policy and plan making, it should have regard for cumulative, regional and long-term impacts. CEA can contribute to this process by identifying significant impact interactions between relevant policies, plans, programmes and proposals.

Integrating CEA into the UK SEA process

The EC SEA Directive delineates a number of procedural steps necessary for its implementation and lists the information that should be included in the environmental report. It refers to cumulative effects in Annex 1 in the "likely significant effects" that need to be considered and information provided in the environmental report "should include ... cumulative, synergistic ...", and in Annex 2, where the criteria for determining the likely significance of effects includes "the cumulative nature of the effects" (CEC, 2001).

The legislative mechanism for implementing the SEA Directive is still being deliberated, but draft guidance on the Directive has been developed for regional and local planning in England (ODPM, 2002).[3] This lists plans and programmes that may be covered, from regional to sub-local plans, such as regional planning guidance, regional spatial strategies, district local plans, unitary development plans and local development frameworks (ODPM, 2002). The draft guidance indicates how the assessment can be integrated with sustainability appraisals, which are undertaken by regional and local authorities in the UK. Sustainability appraisal is recognised as a means of helping reconcile economic, social and environmental concerns (Smith and Sheate, 2001).

The draft guidance explains how to carry out an SEA as an integral part of the plan-making process through a step-by-step SEA process linked to the plan-making stages. It suggests that cumulative effects be considered in the collection of baseline data in stage B2: "Have there been significant cumulative or synergistic effects over time? Are there expected to be such effects in the future?" (ODPM, 2002, page 27).

Cumulative effects are further referred to in the assessment of the effects of the plan options on SEA objectives and targets in Stage E1: the "quantification should be particularly considered where effects are already close to threshold, or where cumulative effects are likely" (ODPM, 2002 page 36). In Stage

The nine stages of the SEA process from the draft guidance are the starting point for showing how CEA could be incorporated into the SEA process: there may be social or community cumulative effects, but the focus of this framework is on environmental effects

E4: Assess the cumulative and synergistic effects of the draft preferred options, a summary matrix is presented showing short-term and longer-term cumulative effects of the preferred option.

There are nine stages to the SEA process that are identified in the draft guidance. These are taken as the starting point and Figure 1 then seeks to show how CEA could be incorporated into the SEA process and highlights the information required for the consideration of cumulative effects. Although there may be social or community cumulative effects, the focus of the CEA framework described here is on the effects on the environment.

The CEA *Practitioners' Guide* (Hegmann *et al*, 1999) suggested a series of steps and some principles for incorporating CEA into the EIA process. These steps have been adapted in Figure 1 in order to be incorporated into the SEA process proposed by

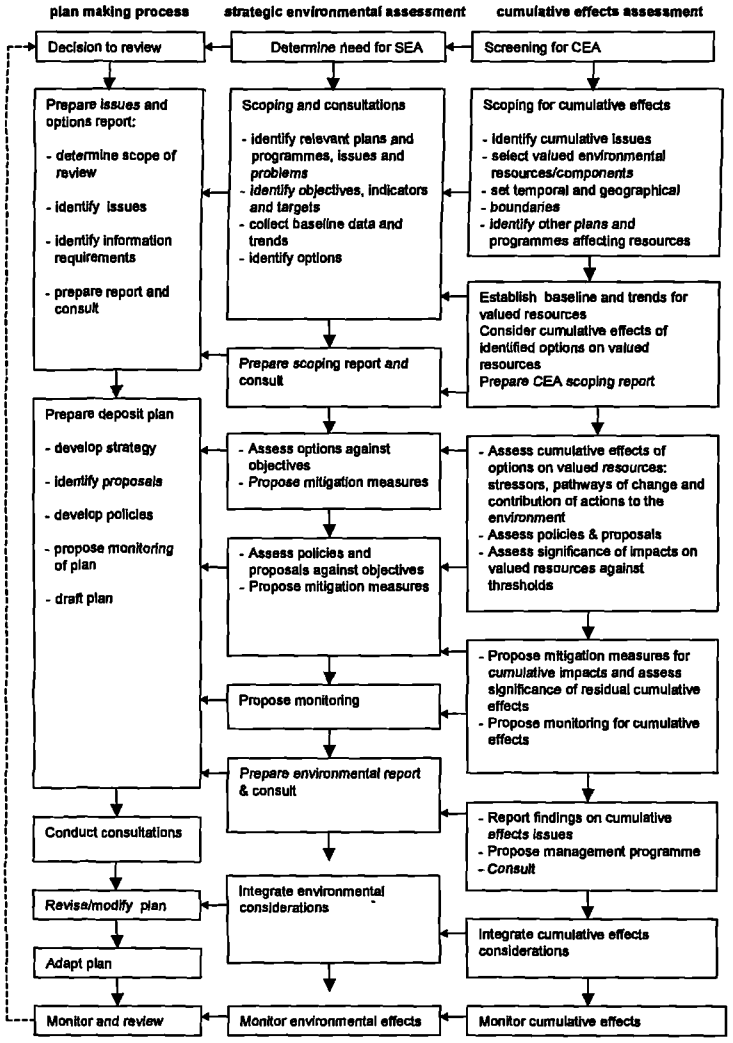


Figure 1. Proposed framework for integrating CEA, SEA and the plan making process

the UK draft SEA guidance. The stages for plan making were derived from the draft SEA guidance and the Government's guidance on plan preparation and management of the development plan process (ODPM, 2002).

Cumulative effects assessment should be integrated into the SEA process and the cumulative effects considerations at each stage of the SEA process are discussed briefly below:

Screening Screening is conducted to determine whether an SEA or CEA on a plan is required under the implementing legislation. The EC SEA Directive states that an environmental assessment should be carried out for all plans and programmes "which determine the use of small areas at local level and minor modifications to plans and programmes where Member States determine that they are likely to have significant environmental effects" (Article 3(3)). The likely significant effects include cumulative effects, as listed in Annex 1. The focus at this stage is to determine whether important environmental considerations may arise as a result of the implementation of the plan or proposal. Other considerations or 'triggers' for initiating CEA within SEA, apart from regulatory requirements, may be driven by actual or possible declines in potentially affected natural resources (Williamson, 1993).

Scoping This is the process of identifying, from a broad range of problems, a number of priority issues to be addressed. Scoping involves identifying the key issues of concern and the valued environmental resources so that the assessment remains focused (Hegmann *et al*, 1999). At this stage, the assessment objectives for the CEA should be defined (US CEQ, 1997) as well as the environmental protection objectives for the plan area and the identified valued environmental resources.

The Canadian guidance on SEA (CEAA, 2000) suggests a preliminary scan, the focus of which should be on identifying strategic considerations at a relatively general or conceptual level. To facilitate this a 'characterisation' exercise, as suggested by Smith and Sheate (2001), could be undertaken before the actual assessment to set out the key characteristics of the geographical area covered by the plan. Targets and indicators for valued resources can be identified at this stage. There are national and regional indicators as well as indicators for particular sectors, such as those identified in biodiversity action plans that could be useful. Information requirements on valued resources should be identified. The tasks for scoping include:

- identify cumulative issues of concern;
- select valued environmental resources, such as natural resources or nature conservation areas;
- identify broad temporal and geographical boundaries;
- identify other plans and programmes that may affect the same valued resources, such as community strategies and urban regeneration plans;
- identify potential impacts resulting from the plan and other plans and programmes

Collect baseline data and establish trends for the valued resources This involves characterising the resources or ecosystems identified in scoping in terms of their response to change and capacity to withstand stresses and defining a baseline condition for the resources (US CEQ, 1997).

Identify options The overall potential cumulative effects of the different options on the valued resources are compared, in order to identify those that are more sustainable and likely to result in fewer detrimental cumulative environmental effects.

Prepare scoping report and consult This report should include what information and studies are required to assess the overall cumulative impact of the plan.

Analysis of effects and identification of mitigation Kingsley (1997) suggests two stages in the analysis of effects of the plan. Initially, this involves establishing the cumulative effects context specific to the plan area. The main sources of stress, pathways, and effects and trends are identified; these can be used as the baseline. Once the context is established, the analysis then focuses on the potential changes arising from the plan. Potential cumulative impacts can come from the plan, policies and proposals:

- The analysis of effects involves the assessment of the plan's options on the valued resources by identifying the main sources of stress, pathways of change and the potential effects. A model of cause-and-effect relationships between stresses and resources can be useful in identifying impacts on the valued resources (US CEQ, 1997).

  In determining the significance of the impacts, an appropriate baseline or threshold condition must be established, beyond which adverse impacts may occur. There are regulatory thresholds that can be used, such as those for air quality (for example, limits for NO_2 and PM_{10} were set by the EU Directive 99/30/EC (CEC, 1999)) or for noise (*Planning Policy Guidance 24* (DOE, 1994b) recommends noise exposure categories). Significance of effects can also be determined in the context of the SEA/CEA objectives identified earlier.

  Some considerations in assessing effects are the parameters for measuring the effects on the valued resources, what determines their present condition and how the proposed action or plan in combination with other existing or approved actions or plans will affect their condition (Hegmann and Yarranton, 1995).
- The analysis of the cumulative effect of plan

policies and proposals involves identifying the main sources of stress, the pathways of change and their overall effect on the valued resources. The process is similar to assessing the impact of the plan option, but at a more detailed level, particularly in terms of the proposals. For example, interactions of proposals (housing and commercial developments) may cause cumulative effects on a particular resource (water).

Mitigation By analysing the cause-and-effect relationships resulting from cumulative effects, measures to mitigate effects or enhance resources can be developed (US CEQ, 1997). The US National Environmental Policy Act (NEPA) guidance goes on to suggest that the key to developing constructive mitigation strategies is determining which of the cause–effect pathways results in the most effect. To be successful, mitigation measures at the plan level should be long term and regionally based and should rely on interagency efforts to mitigate regional- or area-wide effects (Hegmann *et al*, 1999).

Evaluation of significance Although mitigation measures for the plan, policies and proposals have been recommended, there will inevitably be residual effects. There is a need, therefore, to assess the significance of residual cumulative effects. The results of the study should be compared against thresholds and objectives of the SEA.

Propose monitoring The monitoring programme of the plan's effects should include the monitoring of the overall cumulative effects on valued resources. Because of the complexity of cumulative effects problems particularly at a strategic level, there will be a great deal of uncertainty about impact predictions and so monitoring is critical in order to assess the accuracy of the predictions and to check the effectiveness of mitigation measures (Canter, 1996). The NEPA guidance on CEA suggests an adaptive management approach in conjunction with monitoring that could provide a flexible programme for achieving any changes in mitigation (US CEQ, 1997).

Prepare environmental report and consult The report should include findings on potential cumulative effects and propose a management programme for them.

Take consultation results into account In terms of CEA, consultations can be useful in identifying goals and valued environmental resources.

The SEA draft guidance for England suggests a quality assurance checklist for the SEA process. To determine whether the SEA/SA process has integrated cumulative effects considerations into the plan-making process, the criteria suggested by Kotze (2001) could be adapted and used.

Conclusions

The consideration of cumulative effects in the UK planning process could be improved by integrating CEA into the strategic planning levels. This would provide an opportunity for these effects to be considered earlier on in the planning cycle and, by providing a context or baseline for cumulative effects, the plan CEA could facilitate CEAs at project level to assess the contribution of their proposal. The results of the interview survey indicate that a majority of experts and practitioners favour integrating CEA into SEA of plans. There were also some who preferred integrating CEA into sustainability appraisals, since planners are more familiar with the process.

In theory, CEA fits better into SEA because CEA uses a baseline approach for assessing the effect on the valued environmental resource. However, the draft guidance for the SEA Directive for England incorporates the SEA process into sustainability appraisals. A framework for integrating CEA into this process has been presented in this paper. The proposed framework identifies key steps and activities to address cumulative effects at each stage of SEA.

Problems regarding the lack of clear understanding of cumulative effects persist, as shown by the results of the interview survey. Although the draft guidance on SEA for England provides some definitions of cumulative effects, there is still a need for guidance on the concept of cumulative effects and how to do a CEA for practitioners and planners. This paper presents a generic framework for CEA within SEA of plans, which may be helpful to planners undertaking plan reviews. With some adaptation, the CEA process described here may have wider application to other types of plans, such as management plans by other agencies.

One of the key reasons why CEA has not been carried out effectively in the past has been the lack of effective processes through which cumulative environmental effects can be identified and assessed (there has been little enough incentive for developers to undertake CEA as part of project EIA). By tying CEA firmly into the various levels of strategic planning and decision-making, clearer opportunities and reasons are created for undertaking CEA. This in turn will make CEA as part of EIA easier to apply. The further development of appropriate methodologies and guidance on how to carry out CEA within SEA is likely to follow, but only once the need to do so is in place.

Notes

1. The CEA framework presented in this paper is currently being applied to a number of urban regeneration case studies at different strategic levels within the Thames Gateway area.
2. Local development frameworks are proposed by the UK Government (DTLR, 2001) as the means of providing the local strategic planning dimension in England and Wales now regional planning is becoming more formalised, and as an

alternative to the current system of county and local level development plans.

3. The final version of the English guidance was published by ODPM in October 2003 as *The Strategic Environmental Assessment Directive: Guidance for Planning Authorities*, available at <http://www.odpm.gov.uk/stellent/groups/odpm_planning/documents/page/odpm_plan_026670.pdf>.

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