Gateway Energy Centre

ENVIRONMENTAL STATEMENT
Volume 1

Prepared by

PARSONS BRINCKERHOFF

February 2010

CONTENTS

LIST OF ABBREVIATIONS

AADT	Annual Average Daily Traffic
ACC	Air Cooled Condenser
AGI	Above Ground Installation
AGLV	Areas of Great Landscape Value
AHLV	Area of High Landscape Value
AOD	Above Ordnance Datum
AQMA	Air Quality Management Area
BAT	Best Available Technique
BAP	Biodiversity Action Plan
BERR	Department for Business Enterprise and Regulatory Reform
BGS	British Geological Society
BTO	British Trust for Ornithology
CCGT	Combined Cycle Gas Turbine
CCR	Carbon Capture Ready
CCS	Carbon Capture and Storage
CDM	Construction Design and Management
CECL	Coryton Energy Company Limited
CEMP	Construction Environmental Management Plan
CHP	Combined Heat and Power
CHPA	Combined Heat and Power Association
CHPQA	Quality Assurance for Combined Heat and Power
CO	carbon monoxide
CO_2	carbon dioxide
COMAH	Control of Major Accident Hazards
COSHH	Control of Substances Hazardous to Health
CPI	Confederation of Paper Industries
CRF	Congestion Reference Flow
CSM	Conceptual Site Model
°C	Degrees Celsius
DAS	Design and Access Statement
dB(A)	decibels (absolute)
DBA	Desk Based Assessment
DC	Direct Current
DCLG	Department of Community and Local Government
DCS	Distributed Control System
DECC	Department of Energy and Climate Change
DEFRA	Department for the Environment, Fisheries and Rural Affairs
DETR	Department of Environment Transport and the Regions
DFO	Distillate Fuel Oil
DfT	Department for Transport
DLN	Dry Low NO_x
DMRB	Design Manual for Roads and Bridges
DP	Dubai Ports
DPD	Development Plan Document
DTI	Department for Trade and Industry
EA	Environmental Assessment
EC	European Community
EEP	East of England Regional Spatial Strategy
EERA	East of England Regional Assembly
EHO	Environmental Health Officer
EIA	Environmental Impact Assessment
EMMP	Environmental Mitigation and Monitoring Plan
EMOR	Energy Markets Outlook Report
EPR	Environmental Permitting (England and Wales) Regulations 2007
ES	Environmental Statement
ESCO	Energy Service Companies
ETG	Essex Thames Gateway
ETS	Emission Trading Scheme
EU	European Union

EWT	Essex Wildlife Trust
FGD	Flue Gas Desulphurisation
FRA	Flood Risk Assessment
g/MWh	grams per megawatt hour
GEC	Gateway Energy Centre
GECL	Gateway Energy Centre Limited
GW	gigawatt
GWe	gigawatts electric
ha	hectare
HEO	Harbour Empowerment Order
HER	Historic Environment Record
HGV	Heavy Goods Vehicle
HRSG	heat recovery steam generator
HSC	hazardous substances consent
HSE	Health and Safety Executive
HV	high voltage
IEEM	Institute of Ecology and Environmental Management
IPC	Infrastructure Planning Commission
JNCC	Joint Nature Conservation Committee
JSA	Job Seekers Allowance
km	kilometre
km^2	Kilometre squared
LAQM	Local Air Quality Management
LBAP	Local Biodiversity Action Plan
LCPD	Large Combustion Plant Directive
LCI	Landscapes of County Importance
LCV	lower calorific value
LDD	Local Development Documents
LDF	Local Development Framework
LDS	Local Development Scheme
LG	London Gateway
LLCA	Local Landscape Character Area
LNG	Liquefied Natural Gas
LNR	Local Nature Reserve
LPA	Local Planning Authority
LVIA	Landscape and Visual Impact Assessment
m	metre
m^2	Metres squared
m/s	Metres per second
$\mu g/m^3$	micrograms per metre cubed
Mm/s	Millimetres per second
mg/Nm^3	milligrams per normal metre cubed
MJ/m^3	megajoules per metre cubed
MWe	megawatts electric
MWth	megawatts thermal
NAQS	National Air Quality Strategy
NE	Natural England
NGC	National Grid Company
NMR	National Monuments Record
NNR	National Nature Reserves
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NPS	National Policy Statement
NRTF	National Road Traffic Forecast
NSCA	National Society for Clean Air
NSIP	nationally significant infrastructure projects
NSR	Noise Sensitive Receptors
NTS	Non-Technical Summary
NTaS	National Transmission System
NVQ	National Vocational Qualification
OAU	Oxford Archaeology Unit
OEMP	Operational Environmental Management Plan
OFGEM	Office of Gas and Electricity Markets

OPA	Outline Planning Application
OS	Ordnance Survey
OSDR	OFGEM Sustainable Development Report
PAHDI	Prenatal Attachment and Healthy Development Intervention
PB	Parsons Brinckerhoff Limited
PCB	polychlorinated biphenyl
PCPA	Planning and Compulsory Purchase Act
PM	Particulate Matter
PPE	Personal Protective Equipment
PPG	Planning Policy Guidance
PPS	Planning Policy Statement
PPV	peak particle velocity
RFC	ratio of flow to capacity
RSPB	Royal Society for the Protection of Birds
RSS	Regional Spatial Strategy
SAC	Special Area of Conservation
SAM	Scheduled Ancient Monument
SCI	Statement of Community Involvement
SCR	Selective Catalytic Reduction
SEE	Spalding Energy Expansion
SEEL	Spalding Energy Expansion Limited
SINC	Site of Importance for Nature Conservation
SMR	Sites and Monuments Record
SO_x	Sulphur dioxide
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SUDS	Sustainable Urban Drainage System
SWMP	Site Waste Management Plan
SYS	Seven Year Statement
TBC	Thurrock Borough Council
TBLP	Thurrock Borough Local Plan
TCPA	Town and Country Planning act
TEDS	Thurrock Economic Development Strategy
TMP	Transport Management Plant
TTGDC	Thurrock Thames Gateway Development Corporation
TUDP	Thurrock Unitary Development Plan
TWAO	Transport and Works Act Order
UK	United Kingdom
UK BAP	United Kingdom Biodiversity Action Plan
UXO	Unexploded Ordnance
VER	Valued Ecological Receptor
ZTV	Zone of Theoretical Visibility

PREFACE

PREFACE

Gateway Energy Centre Limited (GECL) proposes to construct a Combined Cycle Gas Turbine (CCGT) Power Plant to be known as Gateway Energy Centre or GEC.

GEC will be located on land within the London Gateway (LG) Port / LG Business and Logistics Park development, collectively called the LG Development. The LG Development, promoted by DP World, is currently in the early stages of construction.

GEC will provide up to 900 megawatts electric (MWe) of electrical generation capacity. This will include the provision of up to 150 MWe to the LG Development, which is expected to meet its long-term electricity requirements. Additionally, there is also the possibility for GEC to supply heat in the form of steam or hot water to facilities and / or customers in the vicinity of the site.

This Environmental Statement (ES) has been prepared by Parsons Brinckerhoff Limited (PB) on behalf of GECL and details the results of a comprehensive and independent study of the likely significant environmental impacts of GEC and the mitigation measures designed to minimise any significant adverse environmental impacts.

This ES has been prepared to accompany the application for consent to construct and operate an electricity generating station with an output greater than 50 MWe.

The application is made under Section 36 of the Electricity Act 1989 to the Department of Energy and Climate Change (DECC). Additionally, on granting any consent under Section 36 of the Electricity Act 1989, the Secretary of State for DECC may direct that planning permission for the development under Section 90 of the Town and Country Planning Act 1990 shall be deemed to be granted. As a new Section 36 Consent application is required for GEC, it is not therefore necessary to apply for separate planning permission from the relevant Planning Authority, in this case Thurrock Thames Gateway Development Corporation (TTGDC). However TTGDC remains the relevant Planning Authority within the meaning of Paragraph 2 of Schedule 8 of the Electricity Act 1989 and a Statutory Consultee to DECC during the consenting process. As such TTGDC have been consulted during the preparation of this ES.

Should members of the general public wish to make a representation regarding the Consent application for GEC then these should be forwarded to the Secretary of State for DECC.

For the Attention of:

Mr Gary Mohammed
Electricity Supply Consents
Department of Energy and Climate Change
Area A
3rd Floor
3-8 Whitehall Place
London
SW1A 2HD

Copies of the Consent application with a plan showing the land to which it relates, the ES explaining GECL's proposals in more detail and presenting an analysis of the environmental implications of GEC as well as a Non-Technical Summary (NTS) of the ES may be inspected during normal office hours at the following addresses:

Thurrock Council
Civic Offices
New Road
Grays
Essex
RM17 6SL

Thurrock Thames Gateway Development Corporation
Gateway House
Stonehouse Lane

Purfleet
Essex
RM19 1NX

Corringham Library
Communities, Libraries and Cultural Services
St. John’s Way
Corringham
Essex
RM17 7LJ

Stanford-le-Hope Library
High Street
Stanford-le-Hope
Essex
SS17 0HG

Alternatively, paper copies of this ES (including Volumes 2 and 3 and the stand alone documents) can be purchased for a fee of £250 for each copy by writing to:

Richard Wearmouth
Parsons Brinckerhoff Limited
Amber Court
William Armstrong Drive
Newcastle Business Park
Newcastle-Upon-Tyne
NE4 7YQ

CD copies of this ES (including Volumes 2 and 3 and the stand-alone documents) can be purchased for a fee of £5 each.

Cheques should be made payable to Parsons Brinckerhoff Limited.

Copies of the NTS are available free of charge. An electronic version of the consent application and associated reports, including the ES, can be downloaded free of charge at the GEC website:

http://www.gatewayenergycentre.co.uk

SECTION 1

INTRODUCTION

1 INTRODUCTION

1.1.1 GECL seeks consent principally for:

- 2 No. gas turbines
- 1 No. or more steam turbines
- 2 No. heat recovery steam generators (HRSG)
- 1 No. or more auxiliary boilers
- 2 No. stacks
- Air cooled condensers (ACC) and auxiliary cooling
- 2 No. or more transformers
- Gas receiving facility
- Other plant and equipment
- Water treatment plant
- 1 No. or more Demineralised Water Storage Tank / s
- 1 No. Raw/Firewater Tank
- 1 No. or more switchyard / s
- Buildings (including administration offices, workshop, warehouse, control room, engineering works including contractors temporary laydown areas, vehicle loading / unloading / fencing, roads, storage facilities, lighting)
- Ancillary plant and equipment.

In addition to the above, landscaping and biodiversity provision and storm water ponds may be incorporated into the scheme

1.1.2 The Consent application is accompanied by the following documents:

- Environmental Statement
    - Volume 1 – Main Text
    - Volume 2 – Technical Appendices;
    - Volume 3 – Figures.
- Non-Technical Summary
- Carbon Capture Ready (CCR) Feasibility Study (A);
- Combined Heat and Power (CHP) Assessment (A);
- Design and Access Statement;
- Planning Statement; and
- Statement of Community Involvement.

(A – Documents which have not informed the EIA process)

1.2 The GEC Project

1.2.1 GECL proposes to construct a Combined Cycle Gas Turbine (CCGT) Power Plant to be known as Gateway Energy Centre or GEC.

1.2.2 GEC will be located on land within the London Gateway Port / London Gateway Business and Logistics Park development, collectively called the LG Development.

The LG Development, promoted by DP World, is currently in the early stages of construction.

1.2.3 The application site location is shown in Figure 1.1 and Figure 1.2. The Ordnance Survey (OS) Grid Reference of the centre of the site is approximately 573209, 182165. An aerial photograph showing the approximate location of the GEC site is shown in Figure 1.3.

1.2.4 GEC will provide up to 900 MWe of power generation capacity. This will include the provision of up to 150 MWe to the LG Development, which is expected to meet their long-term electricity requirements. The electricity generated at GEC will most likely be dispatched to the High Voltage (HV) National Grid system via a new HV underground cable, an overhead line or a combination of both, to a new substation to be constructed by National Grid most likely at Mucking Flats. A separate Consent application will be submitted for the HV cable / over head line connection in due course. National Grid will be responsible for the locating and permitting of the new substation.

1.2.5 GEC will burn natural gas only. The natural gas used as fuel will most likely be taken from a new underground pipeline to be constructed from the National Grid National Transmission System (NTaS) Number 5 Feeder pipeline. A separate Consent application will be submitted for the gas pipeline in due course.

1.2.6 The application site boundary for GEC incorporates areas to the north and west which may be used for temporary laydown during construction, with an overall size of approximately 29.1 hectares (71.9 acres). Once constructed the GEC site will be approximately 11.3 hectares (28.0 acres) in size (including the CCR land). The GEC site is situated on the north bank of the Thames Estuary and lies approximately 6 km east of the A13 Road. The A1014 dual carriageway (The Manorway) lies approximately 0.5 km to the north of the site and runs east to west to provide a link with the A13, which in turn links in with the M25 at Junction 30.

1.2.7 The nearest residential settlements are at Corringham and Fobbing which lie approximately 4 km to the west, Canvey Island which lies approximately 5 km to the east and Basildon which lies approximately 7 km to the north.

1.2.8 To the east of the GEC site lies the existing 800 MWe CCGT Power Station owned and operated by Coryton Energy Company Limited (CECL Power Station) (700 m east) and the existing Coryton Oil Refinery (950 m east) owned and operated by Petroplus.

1.2.9 In addition to electricity generation, there is also the possibility for GEC to supply heat in the form of steam or hot water to facilities and / or customers in the vicinity of the site. This is discussed in detail in the CHP Assessment that accompanies the Section 36 Consent application.

1.2.10 GEC will likely comprise two gas turbine units which will be fuelled by natural gas. Each unit will comprise a gas turbine and a heat recovery steam generator (HRSG) which will serve steam turbine equipment.

1.2.11 The natural gas will be burnt in the combustion chamber of each gas turbine from where the hot gases will expand through the gas turbine to generate electricity. The hot exhaust gases are then used in the HRSG to generate steam, which in turn is used to generate electricity via the steam turbine equipment. The use of a combined gas and steam cycle increases the overall efficiency of the power plant.

1.2.12 As such, GEC will be capable of generation in combined cycle mode with an overall electrical generation efficiency of approximately 55 per cent based on the lower calorific value (LCV) of the fuel. This efficiency rating does not take into account the potential for added efficiency if it proves technically and economically feasible to supply waste heat.

1.2.13 The spent steam leaving the steam turbine equipment will pass to an Air Cooled Condenser (ACC) where it will be condensed. The resultant condensate will be returned to the HRSGs for reuse. The use of ACCs has the potential to eliminate other environmental impacts associated with other cooling systems.

1.2.14 It is proposed that the gas turbines chosen for GEC will be equipped with standard proven pollution control technology, known as Dry Low NO_x combustion, which will limit the production of NO_x to a maximum of 50 mg/Nm^3 during gas firing at outputs above 70 per cent load. This technique is considered to represent the Best Available Technique (BAT) for limiting emissions of NO_x to atmosphere from gas turbines. During times where supplementary (duct) firing is used the NO_x emissions level may increase slightly, but should be no more than 64.4 mg/Nm^3.

1.2.15 Natural gas is a clean fuel and does not produce the particulate or sulphur emissions associated with burning coal. Consequently flue gas cleaning equipment is not required. Backup firing on distillate fuel oil (DFO), or any other oil, is not proposed. There will be no bypass stacks installed to permit power generation in the event of the steam turbine equipment being unavailable.

1.2.16 The flue gases will be discharged via two 75 m stacks.

1.2.17 GEC may potentially have a positive net effect on climate change as it will likely replace other fossil fuel sources of electricity generation that have greater CO_2 emissions per unit output.

1.2.18 In addition, GEC will be designed so as to be CCR, with space made available in the design to allow for the retrofitting of a carbon capture plant in the future.

1.2.19 GEC has a confirmed electrical high voltage grid connection date for 2014. As such, the scenario considered in this ES would see construction commencing in around 2012, connection and commissioning commencing in around 2014, and full operation commencing in around 2015.

1.2.20 During the construction of GEC, the direct workforce is expected to peak at approximately 600 personnel. During the operation of GEC, the workforce would be of the order of 15 to 25 personnel if operated in conjunction with CECL Power Station, or up to 40 personnel if operated on a stand-alone basis. Experience at the existing CECL Power Station suggests there could be of the order of 10 to 15 additional indirect jobs at the site. There will also be additional indirect jobs for contracted engineering staff during maintenance shutdowns.

1.2.21 The development of a CCGT Power Plant, such as the proposed GEC, would have a significant capital cost, and a proportion of this, typically anywhere up to 30 per cent, is likely to be spent locally during the construction phase. Furthermore, GEC would also represent an additional annual income source to the local economy during the operational phase.

1.2.22 GEC will be capable of operating throughout the year and will be designed to have an expected operational life in the order of 35 years.

1.2.23 The development of GEC would have a capital cost in the order of £600 million. Additionally, GEC would also represent a significant income source to the local economy during operation.

1.2.24 Further details describing GEC are provided in Section 4.

The LG Development

1.2.25 GEC will be located on land within the LG Development. The location of the application site within the LG Development is shown in Figure 1.4.

1.2.26 The LG Development will involve the redevelopment of the former Shell Oil Refinery site at Shell Haven near Corringham and Stanford-le-Hope (Essex) together with associated transport connections, reclamation of part of the foreshore of the River Thames Estuary, and dredging of higher parts of the navigation channel within the Estuary to accommodate the passage of container vessels.

1.2.27 Once complete the LG Development is expected to become the most advanced deep-sea container Port in the UK, capable of handling approximately three and a half million cargo containers annually. The LG Business and Logistics Park will serve the Port and offer some nine million square feet of advanced business space for distribution and manufacturing companies.

1.2.28 Further details of the LG Development, and the GEC site surroundings, are provided in Section 5.

1.3 The Developer

1.3.1 GEC will be owned and operated by GECL. GECL and the nearby Coryton Energy Company Limited (CECL) are both part of the InterGen group.

1.3.2 InterGen, formed in 1995, is a global power generation company with 12 power plants representing an equity share of 6 254 MWe of production capacity. InterGen's plants are located in the UK, the Netherlands, Mexico, the Philippines and Australia. Historically, the company has developed more than 20 power generation facilities in ten countries across six continents, with a combined generating capacity of over 16 000 MWe.

1.3.3 InterGen is the UK's largest independent gas fired power producer, with three plants in the UK that provide 6 per cent of the country's average demand. Its gas fired power plants are among the cleanest and most technologically advanced in the world.

1.3.4 In the UK, InterGen currently operates three gas fired power plants at Coryton in Essex, Rocksavage in Cheshire and Spalding in Lincolnshire.

1.3.5 InterGen's Coryton Power Station is an 800 MWe CCGT operated by CECL and is situated 700 m to the east of the proposed GEC.

1.3.6 Additionally, in March 2009, Spalding Energy Expansion Limited (SEEL) submitted a Section 36 Consent application for a 900 MWe expansion at the Spalding CCGT Power Station site (known as the Spalding Energy Expansion or SEE). SEEL is an affiliate of Spalding Energy Company Limited, and both are part of the InterGen group.

1.4 Overview of Consenting Process

1.4.1 This ES has been prepared to accompany the application for consent to construct and operate an electricity generating station with an output greater than 50 MWe.

1.4.2 The Consent application has been made under Section 36 of the Electricity Act 1989.

Section 36 Consent under the Electricity Act 1989

1.4.3 Section 36 of the Electricity Act 1989 requires that those seeking to construct, extend or operate an electricity generating station with an output of over 50 MWe located within England and Wales must apply to the Secretary of State for DECC for consent. Section 90 of the Town and Country Planning Act 1990 provides that on granting any consent under Section 36 of the Electricity Act 1989, the Secretary of State for DECC may direct that planning permission for the development shall be deemed to be granted.

1.4.4 As GEC will have an output of up to 900 MWe, it currently falls within the requirements of Section 36 of the Electricity Act 1989 and accordingly GECL has submitted an application to the Secretary of State for DECC for a Section 36 consent and deemed planning permission.

1.4.5 The Section 36 Consent application procedures are comprehensive, and bring the views of the Local Planning Authority, local community, Consultative Bodies (such as the Environment Agency (EA), Natural England (NE), Royal Society for the Protection of Birds (RSPB) and other interested parties) into the decision making process.

Other Consent / Permits Required

In addition, GEC may also require the following consents / permits:

- Energy Policy Clearance
  Power Stations of 10 MWth or more require energy policy clearance under Section 14 (1) of the Energy Act 1976 if they are to be fuelled by oil or natural gas.
- Environmental Permit
  GEC will be a 'regulated facility' under the Environmental Permitting (England and Wales) Regulations 2007 (EPR) and as such will require an Environmental Permit (EP) to operate.
- European Union (EU) Emission Trading Scheme (ETS) Permit
  GEC will require a permit to emit CO_2 under the EU ETS. The scheme is currently operating in Phase II, which runs from 1st January 2008 until 31st December 2012. Therefore, GEC will make an application under Phase III of the EU ETS, the details of which are currently unknown.
- Consent for a new Transmission Line
  The new transmission line associated with GEC will require consent under either the Town and Country Planning Act 1990 and / or the Planning Act 2008.
- Consent for new Gas Pipeline
  The new underground gas pipeline associated with GEC will require consent under either the Town and Country Planning Act 1990 and / or the Planning Act 2008.

1.5 Environmental Statement

Information to be provided in an Environmental Statement for Section 36 Consent under the Electricity Act 1989

1.5.1 When applying for Section 36 Consent under the Electricity Act 1989, the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000 (as amended) (the Electricity Works EIA Regulations) requires an EIA to be undertaken where the development of a thermal power station with a heat output of 300 MWth, or more, is proposed. GEC exceeds this threshold and therefore an EIA is required.

1.5.2 GECL sought the opinion of a number of parties such as the DECC, TTGDC, Environment Agency (EA), Essex Wildlife Trust (EWT) and Natural England (NE) as to their opinion on the information to be contained within the ES. This has allowed GECL to be clear about the likely significant environmental effects of GEC and therefore the topics on which the ES should focus.

The Resulting Environmental Statement

1.5.3 This ES has been prepared to accompany the Section 36 Consent application for GEC.

1.5.4 Prepared by PB on behalf of GECL, this ES details the results of a comprehensive and independent study of the likely significant environmental impacts of GEC and the mitigation measures designed to minimise the significant adverse environmental effects of the proposed development.

1.5.5 The ES addresses the likely significant environmental effects of GEC covering the following impacts: direct, indirect, secondary or cumulative; short, medium or long term; permanent or temporary; and, positive or negative. Impacts will be considered for the construction, operational and decommissioning phases as necessary.

1.5.6 The ES enables the reader to understand the nature of GEC and to evaluate the likely significant environmental effects, and therefore acts to aid the decision making process and to present information in a readily accessible form.

1.5.7 The ES for GEC comprises three separate volumes, and is structured as follows:

- Volume 1 – Main Text
  - Preface
  - Section 1 : **Introduction**;
  - Section 2 : **Rationale for Development**;
  - Section 3 : **Planning Policy Context**;
  - Section 4 : **Description of GEC**;
  - Section 5 : **Description of GEC Site and Its Surroundings**;
  - Section 6 : **Alternatives**;
  - Section 7 : **EIA Methodology and ES Content**;
  - Section 8 : **Stakeholder Consultations and Additional Studies**;
  - Sections 9 to 17 : Covers the **Environmental Impact Assessment** for each aspect of the environment relevant to the project; and
  - Section 18: **Summary of Mitigation and Monitoring**.
- Volume 2 – Technical Appendices
- Volume 3 – Figures

1.5.8 A Non-Technical Summary (NTS) is also provided. The NTS outlines the key findings of the ES.

1.5.9 Within each EIA section included in Volume 1 of the ES, the Section has been broken down to include a number of sub-sections. These are: introduction; key legislation and planning policies; assessment methodology and significance criteria; baseline conditions and receptors; potential impacts; mitigating measures and monitoring programmes; and cumulative impacts.

1.5.10 The scenario considered in this ES would see:

Start of Construction:	Around 2012
Connection and Commissioning:	Around 2014
Full Operation	Around 2015

1.5.11 Where there is any uncertainty in the likely significant environmental effects, the worst case has been considered to allow final design flexibility. As such, when there is uncertainty as to the nature and extent of an effect it is assumed that the nature and extent will be that which gives rises to the most (in number or frequency) and / or the most significant effects. This ensures that the ES is a comprehensive document, evaluating GEC alternatives with the greatest potential impact.

SECTION 2

RATIONALE FOR DEVELOPMENT

2 RATIONALE FOR DEVELOPMENT

2.1 Background

2.1.1 Electricity is essential in a modern society. It powers a huge variety of things, from computers to lights to kitchen appliances to industrial plant. Therefore a growing economy, combined with the innovation to develop electronic devices, leads to a considerable upwards pressure on the UK energy market.

2.1.2 At present, a number of substantial challenges face the UK energy market, including:

- The forced retirements of existing nuclear and coal / oil plant for safety and environmental reasons; and
- The general rising demand for electricity.

2.1.3 These challenges are discussed in this Section, which provides the rationale for the development of GEC.

2.2 Current Power Generation Capacity and Electricity Demand

2.2.1 Currently, the bulk of power generation in the UK is located in northern areas of England and Scotland, either in the vicinity of the UK coal fields or on the coast where fuel supplies can be readily imported. This situation is much the same for many renewable forms of generation including wind farms and hydroelectric plants that are generally situated in more remote locations where the resources they require are more abundant.

2.2.2 However, the main electricity demand in the UK is in the south (particularly London), the south east, the south west and some parts of the Midlands where demand is increasing.

2.2.3 Therefore, the current situation requires power to be transported to these areas of high demand via transmission lines belonging to the National Grid. As demand increases, the need to reinforce the electricity transmission system arises and more long distance transmission lines are required.

2.2.4 An alternative to new long distance transmission lines is to generate more electricity in the areas where it is needed. This not only helps negate the need for long power lines, but also gives the added environmental benefit of reducing electrical transmission losses which occurs as the electricity is transported along the transmission lines.

2.2.5 Transmission losses can amount to a significant quantity of electricity, such that a power station generating 1000 MWe in the north of England / Scotland would provide less than 940 MWe by the time it reached consumers in the south of England.

2.2.6 Currently, the UK has a total electricity generating capacity of around 82 GW based on various technologies. This includes approximately 2 GW of electricity generating capacity located in Northern Ireland, and some electricity generating capacity which supplies directly into the local distribution network rather than into the National Grid National Electricity Transmission System[1].

2.2.7 Based on information from UK Energy in Brief 2009, of the electricity distributed into the National Grid National Electricity Transmission System, the bulk of comes from fossil fuelled power stations (Coal – 31 per cent, Oil – 1 per cent and Gas 46 per cent)[2].

2.2.8 However, the Large Combustion Plant Directive (Directive 2001/80/EC) (LCPD) requires power stations to adhere to stringent air quality standards. Several plants

[1] *Energy Markets Outlook, December 2008 (DECC and OFGEM)*
[2] *UK Energy in Brief , July 2009 (DECC)*

throughout the UK, totalling 12 GW, have opted-out of this obligation and, as such, are required to close by the end of 2015 or after 20 000 hours of operation after 1 January 2008 , whichever is sooner.

2.2.9 The operating regimes of these opted-out plants will become a commercial decision to be taken by the plant operators. This means that it will be impossible to predict the timing and impact of the LCPD on the UK generation capacity. However, the Energy Markets Outlook Report, produced by the Department for Business Enterprise and Regulatory Reform (BERR) (now DECC) and OFGEM in October 2007 has forecast that based on historical operating patterns, the allowance of hours will be reached, by some of the opted-out plants, by early 2012.

2.2.10 The main effects in the UK due to the opted-out coal and oil plants are shown in Table 2.1.

TABLE 2.1: IMPACTS OF THE LARGE COMBUSTION PLANT DIRECTIVE ON OPTED-OUT OIL AND COAL PLANTS[3]

Type of Station	Stations	Capacity	Impact
Opted-out Coal	Didcot A Kingsnorth Cockenzie Tilbury Ferrybridge (part) Ironbridge	2100 MWe 2000 MWe 1200 MWe 1100 MWe 1000 MWe 1000 MWe	These stations are required to operate for no more than 20 000 hours after 1 January 2008 and must close by 31 December 2015. However, the plant could re-open as 'new plant' if they meet stringent new plant emissions standards.
	Total	*8400 MWe*	
Opted-out Oil	Fawley Grain Littlebrook	1000 MWe 1400 MWe 1200 MWe	These stations must close by 31 December 2015. They are likely to be used for peaking only (as they only become economical at high electricity prices) and so the 20 000 hour limit is unlikely to constrain their running.
	Total	*3600 MWe*	
	Total (Opted-out)	**12000 MWe**	

2.2.11 In addition, around 7.4 GW of generating capacity will be lost by 2020 due to the planned closure of some nuclear power plant, with an additional loss of 3.6 GW by 2035[3].

2.2.12 The remaining fleet of nuclear power plant and their estimated closure dates is shown in Table 2.2.

[3] Electricity Generating Plant Closures (DECC). Available at: *http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/markets/outlook/outlook_fuel/outlook_fuel.aspx*

TABLE 2.2: REMAINING FLEET OF NUCLEAR POWER PLANT AND THEIR ESTIMATED CLOSURE DATES[4]

Power Station	*Reactor Type*	*Net MWe*	*Start of Operation*	*Estimated Closure*
Oldbury	Magnox	470	1968	2010
Wylfa	Magnox	980	1972	2014
Hartlepool	AGR	1210	1989	2014
Heysham 1	AGR	1200	1989	2014
Hinkley Point B	AGR	1260	1976	2016
Hunterston B	AGR	1210	1976	2016
Dungeness B	AGR	1080	1985	2018
Heysham 2	AGR	1200	1989	2023
Torness	AGR	1200	1988	2023
Sizewell B	PWR	1190	1995	2035

2.2.13 Therefore, only 33 per cent of the current nuclear power plant generating capacity is expected to exist beyond 2020.

2.2.14 The 2007 'White Paper on Energy – Meeting the Energy Challenge' (published by BERR, now DECC) officially recognised the need to replace the retiring power generation capacity in the UK, stating that:

"*If we are to maintain levels of electricity generation capacity equivalent to those available today, then new power stations need to be built in time to replace these closures and to meet increases in demand. On this basis, around 20 to 25 GW of new power stations will be needed by 2020*".

2.2.15 An additional challenge is presented with the projected increases in the demand for electricity. Forecasts from the 2008 National Grid Seven Year Statement indicate that between 3.5 GW (Base Demand) and 7.1 GW (High Demand) of new generation capacity, in addition to that required to replace closures, will be required by 2015 (taking 2008 as the base year).

2.2.16 However, due to the economic downturn and the increasing use of general energy efficiency measures, there has recently been a decrease in the demand for electricity. This is reflected in the more recent forecasts in the 2009 National Grid Seven Year Statement which indicates that there may only be a requirement for between 0.4 GW (Base Demand) and 3.5 GW (High Demand) of new generation capacity by 2015 (taking 2009 as the base year). In making this statement it is important to note that the Seven Year Statement does not take into account plant closures and does not allow for any increase in power demand as the UK exits recession. Market commentators anticipate substantial demand growth in the medium to long term with the rise in the likes of the number of homes and expected growth in electric cars more than off-setting energy efficiency measures.

2.2.17 Current generation availability data, published in the 2008 Energy Markets Outlook Report, indicates that the effective generating capacity in the UK is around 17 per cent lower than the installed capacity. The Report also highlights that the electricity generating industry will face a significant challenge to ensure the timely delivery of new generating capacity following the closures of existing plant and the projected increases in demand.

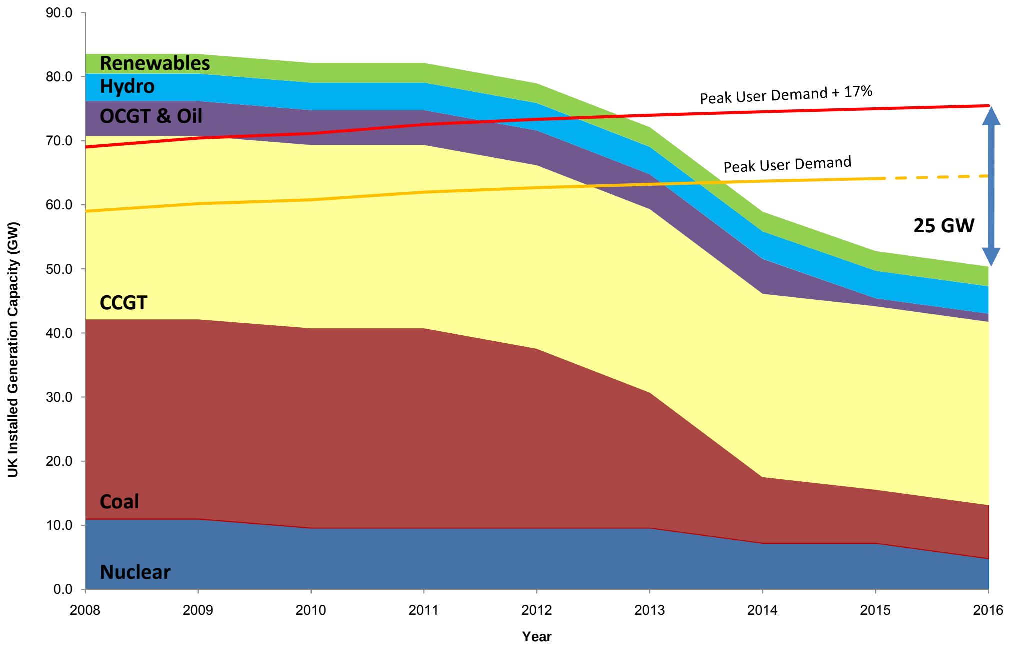
2.2.18 In order to ensure that supply can meet the demand it is necessary to have sufficient available generating capacity to match the highest anticipated 'peak' demand at all

[4] *Data taken from Dynamics of GB Electricity Generation Investment, May 2007*

times. The 2007 'White Paper on Energy – Meeting the Energy Challenge' (published by BERR, now DECC) highlights the need to maintain the security and reliability of the energy supply in the UK.

2.2.19 The margin between demand forecasts and the available generation capacity is a strong indicator of the security of the electricity supply. This has been falling steadily in recent years, indicating that there is a decreasing amount of spare capacity available in the network, see Insert 2.1.

INSERT 2.1: DEMAND PROJECTIONS: PEAK DEMAND AND SUPPLY



2.2.20 Insert 2.1 excludes projects currently in the planning system / consented projects but which are yet to commence electricity production. Furthermore, it assumes an increase in demand of 3.5 GWe by 2015 in line with NGC High Demand forecasts. Even when allowing for expected new projects coming on-line, in the coming years there is clearly a need for additional electricity generation in the UK such as GEC.

2.3 Location of New Power Plant

2.3.1 There is a clear need for additional electricity generation in the UK. The National Grid provides guidance to the market on locations for new generation through its charging for use of the system. As part of the market guidance, the National Grid issues a Seven Year Statement (SYS) that details the areas in which the company would welcome additional generating capacity.

2.3.2 The 2009 SYS suggests that the general area where GEC would be located, i.e. the south east of England, requires a high amount of extra generation. This reflects the south east being the centre of power demand in the UK with the population expected to grow in the coming years. Consequently, locating GEC in the south-east would reduce transmission losses that would be associated with additional electricity generation situated in the north of the country and is therefore considered to be a more environmentally sustainable option.

2.3.3 Locating GEC in the Thames Gateway has the added benefit of meeting the power demands of the LG Development which requires up to 150 MWe of power for its Port and Business and Logistics Park.

2.3.4 Supplying the neighbouring LG Development directly further reduces transmission losses and hence further improves environmentally sustainability.

2.3.5 A further benefit of GEC is that it will offer flexibility of power generation to enable electricity production to be increased or decreased as renewable generation fluctuates e.g. when there is little wind. This further assists towards ensuring security of supply in the south east of England and the UK.

2.3.6 In conclusion, there is a clear need for new generating plant in the UK and the GEC is located in the very region where new capacity is needed most as it is the area of highest and growing demand. The location also ensures that GEC can supply the LG Development directly with up to 150 MWe. These location advantages mean that electricity will not have to be transported far reducing transmission losses – effectively maximising the efficiency of the plant and fuel used.

SECTION 3

PLANNING POLICY CONTEXT

3 PLANNING POLICY CONTEXT

3.1 Overview

3.1.1 This section provides the planning policy context to the proposed development of the GEC. First, it outlines the legislative background, explaining the role of the development plan which is central to policy and decision making and the relevance of other material considerations (Section 3.2). It begins by referring to national planning and energy policy which are material considerations (Section 3.3), then regional policy set out in the East of England Regional Spatial Strategy 2008 (EEP) (Section 3.4) providing the "*top tier*" of the development plan. This is followed by reference to policies in the Thurrock Borough Local Plan 1997 (TBLP), which retains development plan status at this time, then documents comprising Thurrock Council's local development framework (LDF) and to certain TTGDC policies which do not form part of the development plan (Section 3.5). Accompanying this Application, there is a separate Planning Statement which assesses the proposed development of the GEC against policy but is not part of this ES.

3.1.2 The topics in ES Sections 9 to 17 present information to be assessed in accordance with the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000 (as amended); each ES Section includes a schedule listing key planning policies to inform the assessment process.

3.2 Legislative Background

3.2.1 The Planning and Compulsory Purchase Act 2004 (PCPA) introduced powers to give effect to the Government's policy on the reform of the planning system, including a requirement for there to be a regional spatial strategy (RSS) for each region in England such as the EEP, referred to in Section 3.4. The PCPA also provides for the preparation of local development documents (LDDs) by local planning authorities (LPAs) to replace local plans and unitary development plans, although until the relevant LDDs are approved, certain policies in extant plans may have been "*saved*", as in the case of the TBLP policies referred to in Section 3.5.1-3.5.7. Proposed LDDs will be identified in a LPA's local development scheme (LDS). When approved, the LDDs will set out policies for the development and use of land in their area, having regard, amongst other things, to the Government's national policies, the relevant regional spatial strategy (RSS), the LPA's statement of community involvement (SCI), other adopted LDDs and an appraisal of the sustainability of the proposals and a report of the findings.

3.2.2 Section 38(3) of the PCPA stipulates that in England, for any area other than Greater London, the development plan is:

(a) "the regional spatial strategy for the region in which the area is situated; and

(b) the development plan documents taken as a whole which have been adopted or approved in relation to that area."

3.2.3 The development plan documents relevant to the proposed GEC are as follows:

- The East of England Plan The Revision to the Regional Spatial Strategy for the East of England 2008 (EEP); and,
- The saved policies of the Thurrock Borough Local Plan 1997 (TBLP).

3.2.4 The text of relevant policies from these plans is set out in Appendix A.

3.2.5 Section 38 (Development Plan) PCPA states:

"(5) If, to any extent, a policy contained in a development plan for an area conflicts with another development plan the conflict must be resolved in favour of the policy which is contained in the last document to be adopted, approved or published (as the case may be)

(6) *If regard is to be had to the development plan for the purpose of any determination to be made under the planning acts, the determination must be made in accordance with the plan unless material considerations indicate otherwise"*

The EEP 2008 is the most recent of the development plan documents and therefore its policies should be given particular weight relative to the TBLP 1997. As stated in Section 38(6) above, "material considerations" may also be relevant to the decision making process. The Planning System: General Principles 2005; published by the former Office of the Deputy Prime Minister, comments that "The Courts are the arbiters of what constitutes a material consideration" (paragraph 12); among examples, it includes Government's statements of planning policy and emerging policies in the form of draft policy statements (paragraphs 13, 14), which would be applicable to the National Policy Statements (NPS) (Section 3.3.36 / 37).

3.3 National Policy

Planning

3.3.1 Government policy in respect of land use planning is set out in planning policy statements (PPSs), planning policy guidance (PPGs), Circulars, White Papers and Ministerial Statements, which are material considerations that should be taken into account where relevant. Paragraphs 3.3. 2-3.3. 20 provide summaries of PPSs and PPGs relevant to the proposed GEC and the Application Site; paragraphs 3.3. 21-3.3. 25 refer to various Circulars; paragraphs 3.3.26-3.3.39 refer to energy policy.

3.3.2 *PPS1 – Delivering Sustainable Development (2005)*

Addresses the Government's objectives for the planning system, the key principles being social cohesion and inclusion, protection and enhancement of the environment, prudent use of natural resources, sustainable economic development, integrating sustainable development in development plans and delivering sustainable development including spatial plans, design and community involvement. Sustainable economic development necessitates choice, including that LPAs should recognise that economic development can deliver environmental and social benefits to be considered "*alongside any adverse local impacts*" (Paragraph 23). PPS1 confirms that where the development plan contains relevant policies, applications for planning permission should be determined in line with the plan unless material considerations indicate otherwise (Paragraph 8).

3.3.3 *Planning and Climate Change – Supplement to PPS1 (2007)*

Identifies tackling climate change as a Government priority for the planning system. The delivery of sustainable development is to be achieved through spatial strategies that include contributing to the Government's climate change programme, providing infrastructure where it is needed, energy efficiency, reduction in emissions, minimising vulnerability and providing resilience to climate change consistent with social cohesion/inclusion, conserving and enhancing biodiversity, reflecting development needs and interests of communities, responding to the concerns of business, and encouraging competitiveness and technological change, in mitigating and adapting to climate change. Accordingly, policies should promote renewable and low carbon energy and supporting infrastructure (Paragraph 19). "*Low carbon technologies are those that can help reduce carbon emissions. Renewable and/or low carbon energy supplies include, but not exclusively, those from biomass and energy crops; CHP/CCHP and (micro HP); waste heat that would otherwise be generated directly, or indirectly, from fossil fue*l" (Glossary).

3.3.4 *PPG2 Green Belts (1995 amended 2001)*

Explains that its purpose is to check the unrestricted sprawl of large built up areas, prevent neighbouring towns from coalescing, assist in safeguarding countryside from encroachment, preserve the setting and special character of historic towns and to assist in urban regeneration by encouraging the recycling of urban land. The objectives of Green Belt are to provide access to open countryside, provide opportunities for outdoor sport/recreation, retain attractive landscapes, enhance landscapes near to where people live, improve damaged/derelict land, secure nature conservation interest and retain land in agricultural/forestry and related uses. The essential characteristic of Green Belt is its permanence, therefore protection must be maintained as far as can be seen ahead. The most important attributes of Green Belts is its openness. There is a general presumption against inappropriate development which is, by definition, harmful to Green Belt (Paragraph 3.1). Very special circumstances to justify inappropriate development will not exist unless the harm is clearly outweighed by other considerations (Paragraph 3.2). Visual amenities of Green Belt should not be affected by proposals for development within or conspicuous from Green Belt (Paragraph 3.15).

3.3.5 *PPS4 – Planning for Sustainable Economic Growth (Paragraph 4)*

Defines economic development as including development within B Use Classes, public and community uses, main town centre uses and "*other development which achieves at least one of the following objectives:*

- *Provides employment opportunities;*
- *Generates wealth; and*
- *Produces or generates an economic output or product."*

The proposed GEC is infrastructure development, it provides a utility service; it satisfies each of the objectives above and is therefore "*economic development*" within the meaning of PPS4.

3.3.6 *PPS9 - Biodiversity and Geological Conservation (2005)*

Sets out national policies for the protection of biodiversity and how the conservation of natural heritage is to be reflected in land use planning. The most important sites for biodiversity are those identified through international conventions and European Directives; Sites of Special Scientific Interest (SSSI) which are not covered by international designations should be given a high degree of protection under the planning system (paragraphs 6/7). The re-use of previously developed land contributes to sustainability by reducing the amount of countryside and undeveloped land required for building (paragraph 13). Development is also seen to provide opportunities for building in biodiversity as part of good design and LPAs should maximise such opportunities in and around development (paragraph 14).

OPDM Circular 6/2005, DEFRA Circular 01/2005 – Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System

Provides administrative guidance on the application of the law relating to planning and nature conservation as it applies in England and complements the expression of national planning policy in PPS9.

3.3.7 *PPS10 - Planning for Sustainable Waste Management (2005)*

Sets out national policies on different aspects of land use planning in England concerning the management of waste; its overall objective being "*to protect human health and the environment by producing less waste and by using it as a resource wherever possible*", including the consideration of waste management in the site preparation/construction processes. It recommends that proposed new development should be supported by waste management plans which are encouraged to identify the volume and type of material to be demolished and/or excavated, opportunities for the reuse and recovery of materials and to demonstrate how off-site disposal of waste will be minimised and managed (paragraph 34).

3.3.8 *PPS11 - Regional Spatial Strategies (2004)*

Sets out procedural policy on RSSs and what is to be taken into account in revisions including priorities for the environment (including countryside and biodiversity protection), transport, infrastructure and economic development (paragraph 1.3).

Annex A to the PPS is a topic based list of information sources to be taken into account, including, but not limited to air quality, biodiversity, climate change, education, energy, environment, health, soil use, sustainable development, waste management and Government policy on energy. Under "*energy*", the annex refers to three documents PPS22 (Renewable Energy), Energy White Paper 2003 and the *Government's Strategy for Combined Heat and Power to 2010*; the list of documents referred to is expected to change over time.

3.3.9 *PPS12 – Local Spatial Planning (2008)*

Sets out the key ingredients of local spatial plans and Government policies to be taken into account by LPAs in producing development plan documents and other LDDs. It is intended that spatial objectives for the local area, set out in the LDF, should be aligned with national and regional plans and shared local priorities set out in sustainable community strategies where these are consistent with national and regional policy. The strategy is to be supported by evidence of what physical, social and green infrastructure is needed, including natural resources for economic development. Among the physical infrastructure delivery agencies referred to are utilities companies.

3.3.10 *PPG13 - Transport (2001)*

Describes its objectives as being to co-ordinate land use, planning and transport, to promote more sustainable transport choices promoting accessibility and reducing the need to travel, especially by car (paragraph 4).

3.3.11 *PPG15 - Planning and the Historic Environment (1994)*

Provides guidance in applying the provisions of the Planning (Listed Buildings and Conservation Areas) Act 1990 to policies for the identification and protection of historic buildings, conservation areas and other historic assets.

3.3.12 *PPG16 - Archaeology and Planning (1990)*

Provides guidance in applying the provisions of the Ancient Monuments and Archaeological Areas Act 1979 and policies for the identification and protection of archaeological remains and monuments and sets out a process for informed decision making involving remains affected by development. The case for the preservation of archaeological remains must be assessed on the individual merits of each case, taking into account policies in the development plan, together with all other relevant policies and material considerations, including the intrinsic importance of the remains and weighing these against the need for development (paragraph 27).

3.3.13 *Consultation Paper on a new PPS15 – Planning for the Historic Environment (July 2009)*

When published, the new PPS15 will replace the current PPG15 and PPG16. The new PPS has been drafted collaboratively by the Department for Communities and Local Government, the Department for Culture, Media and Sport and English Heritage. It envisages a proportionate response to change, focussing "*on what is significant in heritage terms about a place and not just protect all for its own sake*" (paragraph 1.10).

3.3.14 *PPG20 - Coastal Planning (1992)*

Provides a statement of policy in relation to coastal planning for England and Wales. Key policy issues for coastal planning are identified as conservation of the natural environment, development (particularly that which requires a coastal location) risks including flooding, erosion, land instability and improving the environment. *The Consultation Paper on a New Planning Policy on Development and Coastal Change 2009* sets out a planning framework for the continuing economic and social viability of coastal communities in areas of coastal change; it aims to strike the right balance between economic prosperity and reducing the consequences of coastal change on communities, ensuring that spatial strategies take proper account of the impact of physical processes affecting the coastline and decisions regarding the planning and management of coastal defences.

3.3.15 *PPS22 - Renewable Energy (2004)*

Refers to the development of alternative forms of renewable energy which occur naturally and repeatedly in the environment, while noting that improvements in energy efficiency and the development of CHP will make a vital contribution to the objective of cutting carbon dioxide emissions.

3.3.16 *PPS 23 - Planning and Pollution Control (2004)*

Affirms that quality of land, air or water and potential impacts arising from development may be a material planning consideration. With regard to land affected by contamination and the objective to direct development to previously developed sites, the point is made that while the presence of contamination can restrict the use of land, it can also present an opportunity to deal with these risks successfully (paragraph 2). It distinguishes between planning and pollution control as complementary regimes in which LPAs will work on the assumption that the relevant pollution control regimes will be applied and enforced (paragraph 10). In Appendix A, matters to be considered in preparing LDDs and possibly decisions on individual applications, include the economic and wider social needs for development (including potentially polluting development) such as "*the provision of a product or service, the generation of secondary trade with local businesses, the creation of new jobs and meeting regional or national environmental objectives …*". (Appendix A, page 11)

3.3.17 *Annex 1 to PPS23: Pollution Control, Air and Water Quality*

On the matter of planning control and, in particular, need and alternative sites, begins by stating that "*Applicants do not normally have to prove the need for their proposed development, or discuss the merits of alternative sites. However, the nature of polluting or potentially polluting developments and national or regional need for them, or the location of a proposal in an environmentally-designated or sensitive area may make the availability, or lack of availability, of suitable alternative sites material to the planning decision. The assessment of need and of sustainability issues should take into account a comprehensive assessment of social, environmental and economic factors. It should be recognised that the need for a development in a particular location can outweigh negative impacts that would, in other locations, warrant refusing planning permission*" (Paragraph 1.54). Annex 1, Appendix 1C (Paragraph 1C.1) refers to climate change as "*one of the most serious environmental problems the world faces*" and the encouragement the Government gives to reducing greenhouse gas emissions and its support for renewable forms of energy. Annex 1, Appendix 1G, in referring to development control considerations, it notes that air quality will attract greater consideration where a development would be within or adjacent to an Air Quality Management Area (paragraph IG.1). Developers are to be encouraged, where appropriate, to incorporate in their proposals sustainable drainage systems (SUDS) to source run-off from development including car parks, buildings, paved areas, etc. and to store water for non drinking purposes and to enable it to be released more slowly (Annex 1, Paragraph 1.31).

3.3.18 *PPG24 – Planning and Noise (1994)*

Gives guidance to local authorities in England on the use of planning powers to minimise the adverse impacts of noise and its effects on the environment and the quality of life without placing unreasonable restrictions on development. In assessing applications, LPAs should give reasonable consideration to the compatibility of proposed activities with the surrounding uses and, in particular, the potential for increase in noise effects over time, different noise levels throughout the day and night and the nature of the noise effects likely to be produced. It also notes that "*Much of the development which is necessary for the creation of jobs and the construction and improvement of infrastructure will generate noise*" (Paragraph 10).

3.3.19 *PPS25 - Development and Flood Risk (2006)*

Explains how flood risk should be considered at all stages of the planning process to avoid inappropriate development in areas at risk of flooding and to direct development away from areas at highest risk by applying a Sequential Test to the choice of sites. Reference is made to electricity generating power stations, grid and primary sub stations as falling within the category of essential infrastructure, such that the Exception Test may be applied within flood risk vulnerability classification zones 3a/3b. If the Exception Test is passed, the plant should be designed and constructed to remain operational and safe for users in times of flooding. A consultation on proposed amendments to *PPS25 – Development and Flood Risk (August 2009)* sought views on proposed amendments clarifying aspects of spatial planning policy on development and flood risk, which would affect, among others, "*essential infrastructure*". It proposes to amend Table D.2 (Flood Risk Vulnerability Classification) where it may, or may not, be appropriate to locate development in accordance with the compatibility Table D.3. Among the proposed amendments, is the insertion of additional text in the "*highly vulnerable*" category is to clarify that where there is a need to locate, for instance, installations requiring hazardous substances consent that are associated with energy infrastructure which need to be sited in coastal locations or high flood risk areas, these facilities and installations should be classified as essential infrastructure, rather than highly vulnerable (paragraph 3.14). This would include installations for carbon capture and storage which are likely to be sited in coastal locations, and gas storage facilities which may need to be placed in coastal locations or other high flood risk areas. As essential infrastructure, these installations would be subject to the PPS25 Sequential Test, and then the Exception Test if proposed for a high flood risk area. As with other "*essential infrastructure*" in a high risk area, they would need to be designed and constructed to remain operational and safe in times of flood (paragraph 3.30).

3.3.20 *Circular 15/97 - The United Kingdom National Air Quality Strategy and Local Air Quality Management: Guidance for Local Authorities (1997)*

Promotes a corporate approach to the issue of local air quality, gives an introduction to the function of local authorities in delivering the Government's UK National Air Quality Strategy through the Local Air Quality Management (LAQM) system.

3.3.21 *Circular 04/00 – Planning Controls for Hazardous Substances (2000)*

Gives guidance on how the procedures for hazardous substances consents (HSC) operates, including publication of notices, notification of applications to owners of land and the consultation process prior to determination. In considering applications for HSC, hazardous substances authorities must have regard to the provisions of the development plan so far as it is material to the Application.

3.3.22 *Circular 05/05 – Planning Obligations*

Provides guidance to LPAs in England on the use of planning obligations under Section 106 Town & Country Planning Act 1990. Annex A to the Circular sets out the statutory framework for planning obligations; Annex B to the Circular explains the policies of the Secretary of State and provides guidance on the use of planning obligations which LPAs should taken into account when determining applications and drafting policies.

3.3.23 *Circular 06/2005 - Biodiversity and Geological Conservation - Statutory Obligations and their Impact within the Planning System*

Provides administrative guidance on the application of the law relating to planning and nature conservation in England. It compliments PPS9 and the Good Practice Guide. In Part I to the Circular it deals with the conservation of internationally designated sites, SPAs (classified under the EC Birds Directive), Special Areas of Conservation (SACs), designated under the EC Habitats Directive and Ramsar sites listed under the provisions of the Ramsar convention on wetlands of international importance. Part II deals with Nationally Designated Sites (SSSI) and the consultation and notification of processes; Part III covers planning for nature conservation outside designated sites; Part IV deals with the conservation of species and Part V provides advice on other duties and the use of statutory powers. The Circular also states that: "*When dealing with cases where a European protected species may be affected, a planning authority is a competent authority within the meaning of regulation 6 of the Habitats Regulations, and therefore has a statutory duty under regulation 3(4) to have regard to the requirements of the Habitats Directive in the exercise of its functions. So the Directive's provisions are clearly relevant in reaching planning decisions, and these should be made in a manner which takes them fully into account. The Directive's requirements include a strict system of protection for European protected species, prohibiting deliberate killing, catching or disturbing of species, the taking of eggs etc and damage to or destruction of their breeding sites or resting places. Derogations from this strict protection are allowed only in certain limited circumstances and subject to certain tests being met …*" (paragraph 116).

3.3.24 *Circular 1/2006 Guidance on Changes to the Development Control System (2006)*

Provides guidance on changes to the development control system. ES Section 3 to the Circular refers to amendments to the 1990 Act which prohibits, among other things, an LPA from entertaining an application unless it is accompanied by a design statement and an access statement where required. A design and access statement is described at paragraph 6.0 of the Circular as "*a short report accompanying and supporting a planning application to illustrate the process that has led to the development proposal and to explain and justify the proposal in a structured way*." The Application is accompanied by a Design and Access Statement.

Energy

3.3.25 Government energy policy is represented in the following documents, which are material to a consideration of the GEC; reference is also made to the objectives of reducing carbon dioxide emissions while maintaining security of supplies along with reports on the need for additional generating capacity and the Government's commitment to the role of carbon capture storage (CCS). The ES Section 2.2 refers to the main electricity, demand being in the South, London (and parts of the Midlands) and that by siting generating capacity close to where demand exists, there is an environmental and economic benefit of reducing electrical transmission losses, compared with locating generating plant in Scotland. It is also noted in ES Section 3.3 that, in the South of England, a number of large coal/oil fired plants will close as a result of LCPD by not later than the end of 2015. ES Section 6.3 commenting on the operation of alternative power generation technologies, indicates that the use of gas fired electricity generating plant can make a significant contribution to reducing CO_2 emission levels. It is also further explained in ES Section 2.3 and 4.5 that GEC will be capable of meeting incremental requirements of up to 150 MWe to the London Gateway development, as well as improving efficiency through the provision of CHP and the eventual implementation of CCS.

3.3.26 *Our Energy Future - Creating a Low Carbon Economy CM 5761 (Energy White Paper) (2003)*

Identifies three challenges, first climate change, second decline in the UK's indigenous energy suppliers and third, the need to update much of the UK's energy infrastructure. The White Paper refers to four goals: reducing carbon emissions, maintaining reliability of energy supplies, promoting competitive energy markets and ensuring every home is adequately and affordably heated. To achieve these goals, Government identifies "*energy efficiency*" as likely to be the cheapest and safest way of addressing all four objectives with renewable energy playing an important part in reducing carbon emissions and strengthening energy security (paragraph 1.19). On the issue of maintaining reliability of energy supplies, the stated goal is that "*people and businesses can rely on secure supplies of energy – gas, fuel and electricity at predictable prices delivered through the market*" (paragraph 6.1). This is to be achieved through a resilient energy system which requires "*a diverse system based on a mix of fuel types, a variety of supply routes, efficient international markets, back up facilities such as storage and a robust infrastructure*" (paragraph 6.2).

3.3.27 *The Government's Strategy for Combined Heat and Power for 2010 (DEFRA CHP Strategy)*

Reflects Government's belief that combined heat and power (CHP) has an important role to play in achieving the aims of the 2003 White Paper. Whilst the country will fall short of its 10% 2010 CHP target, it is also indicated that Government measures will contribute to future development of CHP. Consultations regarding CHP potential are referred to in ES Section 8 and the Combined Heat and Power (CHP) Assessment.

3.3.28 *Climate Change - the UK Programme 2006/2007/2008.*

The 2006 document discusses the international challenge of climate change, delivering emissions reductions, and adapting to the impact of climate change. It notes that "*The energy supply sector has contributed a large reduction in the UK's greenhouse gas emissions over the past decade … largely through the switch away from more carbon intensive fuels such as coal and oil towards low or zero carbon emissions fuels such as gas, nuclear and renewables*." It predicts that emissions will fall further "*through to 2010 as a result of the impact on electricity demand of existing measures and a further increase in the share of gas fired electricity generation*" (Energy Supply page 32). Subsequently, the 2007 Annual Report to Parliament indicated a reverse trend, in which fuel switching (as a result of price changes) from natural gas to coal for electricity generation was considered primarily responsible for carbon dioxide emissions in 2006 being higher than in 2005 (page 11, paragraph 18). However, the 2008 Annual Report shows carbon dioxide emissions during 2007 being lower than the 2006 figure, resulting from fuel switching back from coal to gas (Overview, page 9, paragraph 4).

3.3.29 *The Energy Challenge – Energy Review (2006) CM 6887*

Identifies two major long-term challenges, tackling climate change as global carbon emissions continue to grow and, delivering secure and clean energy at affordable prices as the UK becomes increasingly dependent on imports for its energy needs. On the matter of electricity generation, it is stated that "*Over the next two decades, the UK will need substantial new investment in electricity generation capacity to replace closing coal, oil and nuclear power stations and to meet expected growth in electricity demand*" (Cm 6887 paragraph 6.4.3). It advises that it is for the private sector to make the necessary investment decisions within the regulatory framework set by the Government and for Government to ensure that this framework provides the right incentives, consistent with the goal of moving to a low carbon economy.

3.3.30 *Meeting the Energy Challenge – A White Paper on Energy (2007) Cm 7124*

Building on the principles set out in the 2003 White Paper, identifies two long term energy challenges of tackling climate change by reducing carbon dioxide emissions and ensuring secure, clean and affordable energy. It addresses energy and climate security, saving energy, heat and distributed generation, the utilisation of oil/gas/coal, electricity generation including investment frameworks, renewables, cleaner coal with carbon capture/storage for fossil fuels and nuclear power research and development, transport, planning and other matters. On the matters of reducing CO_2 emissions, it is stated that:

- *"The sector has made some progress in decarbonising since 1990, largely as result of the increased share of gas-fired generation in the mix"* (paragraph 5.1.10), and
- *"Over the next two decades, the UK will need substantial investment in new generation capacity to replace the closing coal, oil, and nuclear power stations and to meet expected increases in electricity demand."* (paragraph 5.1.11).

The White Paper predicts that some 22.5 GW of existing power stations may close by 2020 and that to maintain levels of capacity equivalent to those of today, new generating capacity needs to be built to meet these closures and increases in demand (paragraph 5.1.11).

3.3.31 *DECC's Energy Markets Outlook Report (December 2008) 2009 (EMOR)*

Refers to the main causes of interruption to energy supply, the additional challenges that will be faced as a consequence of closures (particularly coal plant) by 2016 under LCPD and the expectation of increasing diversity of potential sources of gas supply. The Government's view is that independently regulated competitive energy markets with an appropriate cost of carbon and support for emerging low carbon technologies is the way forward and that "*the best way to deal with future uncertainties is to ensure that the market has access to all technologies*". It notes that coal and gas fired plant have the advantage of being able to operate flexibly, regardless of weather conditions. EMOR 2008 predicts that around 12 GW of coal and oil fired generating plant which "*opted out*" under LCPD will have to close by not later than the end of 2015 and 7.3 GW of older nuclear capacity is scheduled to close by 2020. The EMOR 2009 restates the position that security of supply is a key element of Government Energy policy and correspondingly OFGEM's role in protecting consumers (EMOR 2009, 2.2.1) and it reaffirms the statements of EMOR 2007/8 that around 12 GW of older coal and oil plant will close by 2015 and 7 GW of nuclear stations by 2018 (EMOR 2008, 2.4.3). To complement the carbon markets, Government's plans predict in that its lead scenario around 30% of electricity will be generated from renewable generation sources by 2020 (EMOR 2009, 2.6.1) although to be clear, this includes carbon fuelled plants with CCS. It refers to the gas supply position having been improved by important developments in liquefied natural gas (LNG) import infrastructure at the South Hook and Dragon Terminals in Milford Haven (EMOR 2009, 2.8.1). However, as gas will remain an important part of the energy mix, the Government is clear that it is encouraging new investment in gas storage and import infrastructure through reform of the planning and consents regulatory framework (Box 5.1).

3.3.32 *OFGEM's "Sustainable Development Report" 2007 (OSDR 2007)*

Notes that while the country is likely to meet its present greenhouse gas emissions targets of 12.5% below base year (1990) levels by 2008-2012 under the Kyoto Protocol. "*This has been largely driven by the switching from coal to gas fired electricity production over this period*", which is a reminder of the positive role that has been played by investment in CCGT and other gas fired generating plant (paragraph 3.1). The subsequent OSDR 2008 re-affirms the Government's commitment to facilitating transition to a low carbon economy and to delivering long term secures energy supplies (paragraph 1.7). At the same time, it points to the fact that in the UK "*companies will need to make substantial new investment in power stations, the electricity grid and gas infrastructure*" (paragraph 1.8). It is also pointed out that CCS will be an important technology for the shift to achieve a low carbon economy (OSDR 2007 paragraph 6.23, OSDR 2008 paragraph 5.26). OSDR 2009 restates earlier advice that one of the challenges is to ensure adequate levels of generation over the period that old plants are phased out and new plants brought in. It refers to the Government's ambitious renewables targets of 30% of electricity being sourced from renewables by 2020 compared with 5% today (paragraph 1.6). Figure 25 shows National Grid's predicted generation mix to 2016/16 of which OFGEM says that substantial growth in gas and renewable energy capacity is set to be a feature of the next decade. While connection of CHP has levelled off, OSDR 2009 believes that renewable and low carbon heat will increasingly contribute to targets (Figure 9).

3.3.33 *The UK Low Carbon Transition Plan – National Strategy for Climate and Energy 2009*

Published by DECC refers to the first carbon budgets set in law following Budget 2009 committing to cut the UK's greenhouse gas emissions to the following levels:

Budget	Period	Reduction below 1990 levels
1	2008-2012	22%
2	2013-2017	28%
3	2018-2023	34%

These budgets are in line with those recommended by the Committee on Climate Change. The policy aim is to transform the power sector (Chapter 3) by generating electricity from clean sources such as renewables, nuclear and fossil fuel plants fitted with CCS equipment, which requires an electricity grid with larger capacity and the ability to manage greater fluctuations in electricity demand and supply. "*To make this transition, the Government needs to maintain the right conditions for energy companies to invest very large sums in new power stations*" (Summary page 52). It is planned that this strategy will achieve around 40% of electricity from low carbon sources by 2020 (page 52). In its concept of a "*roadmap*" to 2050, it is acknowledged that it is not possible to predict the precise mix of electricity generating technologies at that time but that the "*roadmap*" needs to be sufficiently flexible to adopt to technical developments in any sector (page 174).

3.3.34 *DECC's Carbon Capture Readiness (CCR) Guidance Note for Section 36 Electricity Act 1989 Consent Applications (URN 09D/810) November 2009*

Refers to Article 33 of the EU Directive on the Geological Storage of Carbon Dioxide (2009/31/EC). Article 33 of the Directive requires that the technical and economic feasibility of retrofitting CCS equipment and the transport of CO_2 storage sites should be assessed by the applicant and the consenting body during the process of deciding whether to grant an operating or construction licence for any new power station with electrical outputs at or over 300 MWe of the type covered by LCPD (paragraph 2). The test of whether a proposed power station is CCR means that DECC has concluded, at the time of consenting, that it will be technically and economically feasible to retrofit CCS equipment. As part of an application for Section 36 consent, applicants will be required to demonstrate:

- *"That sufficient space is available on or near the site to accommodate carbon capture equipment in the future*
- *The technical feasibility of retrofitting their chosen carbon capture technology*
- *That a suitable areas of deep geological storage offshore exists for the storage of captured CO_2 from the proposed power station*
- *The technical feasibility of transporting the captured CO_2 to the proposed storage area; and*
- *The likelihood that it will be economically feasible within the power station's lifetime, to link it to a full CCS chain, covering retrofitting of capture equipment, transport and storage.*
- *Applicants must make clear in their CCR assessments which CCS retrofit, transport and storage technology options are considered the most suitable for their proposed development."*
- *In addition, if applicants' proposals for operational CCS involve the use of hazardous substances, they may be required to apply for Hazardous Substances Consent (HSC). In such circumstances, they should do so at the same time as they apply for Section 36 consent* (see Paragraphs 70 to 82).

3.3.35 *Planning Act 2008 (PA 2008)*

Has introduced a new system of development consents for nationally significant infrastructure projects (NSIPs), including certain energy projects. A major role in the new system is to be played by an independent body called the Infrastructure Planning Commission (IPC), which is to be responsible for examining applications for development consents for NSIPs. The IPC will be responsible for deciding applications when there is a relevant National Policy Statement (NPS) in force, which will have been through a statutory process of public consultation, an appraisal of sustainability and parliamentary requirements have been met. Where a relevant NPS is not in place, the IPC will make recommendations to the Secretary of State. Section 14 PA 2008 includes in the list of NSIPs "*the construction or extension of a generating station".* Section 15 states that a generating station is within the sub-section if:

- *"It is in England or Wales*
- *It is not an offshore generating station, and*
- *Its capacity is more than 50 megawatts."*

On this basis, the proposed GEC would, if the application was to be made at any time from 1.3.10, be a NSIP and would therefore have to be submitted under the PA 2008 to the IPC. However because this Application was submitted in February 2009 under the Electricity Act, it will be determined accordingly. A letter was sent to Chief Planning Officers from the Department of Community and Local Government's (DCLG's) of 9.11.09 (Document 12) drawing their attention to the existence of the draft NPSs *"(13) The new single consent regime for NSIPs will operate alongside the Town and Country Planning regime …." (14) NPSs, are not part of the statutory development plan for purposes of the town and country regime but are statements of national policy on nationally significant infrastructure NSIPs. Regional planning bodies (or new style responsible regional authorities when in place) and local planning authorities (LPAs) must therefore must have regard to NPSs when preparing their plans at regional and local level. Emerging policy in a published draft NPS may also be relevant."* The date for consultations has now passed on are now closed but it should be assumed that, while the draft NPSs may change as a consequence of consultations, these should be viewed as a material consideration in applications for energy infrastructure.

3.3.36 Draft Overarching National Policy Statement for Energy (EN-1)

Sets out national policy for the energy infrastructure constituents of the NSIPs listed in EN-1, namely onshore generating stations of more than 50 MWe (and 100 MWe offshore) produced from fossil fuels, wind, biomass, waste and nuclear (in respect of the sites listed in the Nuclear NPS EN-6 at EN-1, paragraph 1.3.5). In the introduction, it is stated that "*energy is vital to economic prosperity and social well-being and so it is important to ensure that we have secure and affordable energy*" (paragraph 2.1.2). Taking account of the need to achieve reduced carbon emissions and security of supply it is emphasised that the country needs (paragraph 2.1.14):

- Capacity to meet demand at all times, including a greater proportion of low carbon energy with a safety margin of spare capacity;
- Capacity and associated fuel supply chains for power stations must be reliable to meet demand as it arises;
- A diverse mix of technologies and fuels; and
- Effective price signals so that markets have sufficient time to react in a timely way.

In its summary of need (paragraph 3.1), the Government sees its job as setting the strategic framework within which developers of energy infrastructure will operate and that the industry needs to deliver significant amounts of new energy infrastructure over the next 10-15 years, of which the following are of particular relevance to this Application:

- Demand for electricity generation at 2020 is likely to be at levels similar to now, with the possibility of increases beyond then, due to factors such as greater use of electricity to decarbonise heat and transport;
- A large number of existing power stations (oil, coal, nuclear) will have closed;
- A move to low-carbon forms of electricity generation based around renewables/wind nuclear and fossil fuel with carbon capture and storage;
- Net additional electricity generating infrastructure above current UK capacity to ensure adequate supplies in the move towards low carbon forms of energy;
- Under central assumptions, the country needs about 43 GW net of new capacity by 2020 and about 60 GW by 2025, much of which has yet to be consented;
- Around 30% of electricity generation at 2020 will be from renewables, primarily wind generation with smaller amounts of bioenergy (although more is possible and desirable); and
- In addition to nuclear, new fossil fuel generating capacity will be needed to provide additional and flexible supplies, to be constructed so that it is CCR.

3.3.37 *Draft National Policy Statement for Fossil Fuel Electricity Generating Infrastructure (EN-2)*

Concerns generating infrastructure over 50 MWe which is coal fired, gas fired, integrated coal gasification combined cycle and oil/fired (paragraph 1.7.1). It refers to factors influencing site selection by developers as land use, transport infrastructure, water resources and grid connection. On the matter of Government, policy criteria for fossil fuel generating stations, Policy EN-2 refers briefly to CHP, CCR, climate change adaptation and consideration of "*good design*". Reference is also made to impacts of fossil fuel generating stations in respect of emissions to air, landscape and visual impact, noise, dust (applicable to coal), residue management (applicable to coal) and water quality/resources.

3.3.38 *OFGEM Project Discovery Options for delivering Secure and Sustainable Energy Supplies (February 2010)*

Highlights five key issues:

- Need for unprecedented levels of investment to be sustained over many years in energy infrastructure in difficult financial conditions;
- Uncertainty in future carbon prices likely to delay or deter investment in low carbon technology and lead to greater decarbonisation costs in the future;
- Short term price signals not fully reflecting the value customers place on security of supply, such that incentives to make additional peak energy supplies available and to invest are not strong enough;
- Independence with international markets exposes Great Britain to additional risk that may undermine Great Britain security; and
- Higher costs of gas and electricity may mean increasing numbers of consumers experience fuel poverty and industry/business competitiveness is affected.

The document, which invites consultation by 31.3.10, highlights the fact that "*significant action will be called for given the unprecedented challenges facing the electricity and gas industries*." In its comments on timing of policies and investments, it suggests that "*If CCGT plants (which are likely to be the quickest to build) are required to fill any capacity gap, decisions [on] these would also be required by early 2013*" (paragraph 6.5).

3.4 Regional Policy

East of England Plan 2008

3.4.1 The East of England Plan (EEP) which covers the counties of Norfolk, Suffolk, Cambridgeshire, Essex, Hertfordshire and Bedfordshire, together with the relevant sections of the Milton Keynes South Midlands Sub-Regional Strategy 2005 comprises the RSS for the East of England (paragraph 1.4). The EEP "*covers the period to 2021 but sets a vision, objective and core strategy for the longer term. In particular, it seeks to reduce the region's impact on, and exposure to, the effects of climate change and to put in place a development strategy with the potential to support continued sustainable growth beyond 2021*" (paragraph 1.9). Among the key drivers of regional policy, fostering inter-regional and European links via inward investment, transport, trade, key employment clusters; promoting sustainable development, supporting the continued growth of the economy, driving up energy efficiency and carbon performance; reconciling growth with protection of the environment, avoiding adverse effects on sites of European/international importance, concentrating growth at the key centres of development and change while maintaining the general extent of the Green Belt (paragraph 1.11). Matters referred to in this section are core spatial strategy, economic development, culture, transport, environment, carbon dioxide emissions and renewable energy, water and the Essex Thames Gateway Sub Region.

<u>Vision, Objectives, Core Strategy</u>

3.4.2 The overall spatial vision is for the East of England to realise its economic potential and provide a high quality of life for its people, including meeting their housing needs in sustainable inclusive communities, while reducing its impact on climate change and the environment, including through savings in energy (paragraph 2.2). Objectives include:

i. "To reduce the region's impact on, and exposure to, the effects of climate change by:

- *Effecting a major shift in travel away from car use towards public transport, walking and cycling;*
- *Maximising the energy efficiency of development and promoting the use of renewable and low carbon energy sources; and*
- *Reducing the risk of adverse impact of flooding on people, property and wildlife habitats.*

iii. To realise the economic potential of the region and its people by:

- *Facilitating the development needed to support the region's business sectors and clusters, improving skills and widening opportunities in line with the Regional Economic Strategy.*

iv. To improve the quality of life for the people of the region by:

Promoting regeneration and renewal of disadvantaged areas

v. To improve and conserve the region's environment by:

- Ensuring the protection and enhancement of the region's environmental *assets, including the built and historic environment, landscape and water;*
- *Re-using previously developed land and seeking environmental as well as development gains from the use of previously undeveloped land;*
- *Protecting and, where appropriate, enhancing biodiversity though the protection of habitats and species and creating new habitats through development;*
- *Providing a network of accessible multi-functional greenspace; and*

- *Reducing the demand for and use of water and other natural resources and reducing waste whilst increasing the sustainable management of waste."*

3.4.3 The spatial strategy defines a key ambition of the RSS allowing the Region to accommodate higher levels of growth in sustainable ways (paragraph 3.3). One of the three largest Growth Areas is "*Thames Gateway, a regeneration area of national importance which includes part of South Essex (Essex Thames Gateway)*" (paragraph 3.5). This part of Thurrock is within the Essex Thames Gateway, one of the Growth Areas "*Where the most significant development and regeneration challenges in the region are concentrated*" (paragraph 3.8).

3.4.4 Policy SS1 (Achieving Sustainable Development)

Gives weight to a number of key principles set out in Government's national policies, including *"achieving a sustainable economy"*; helping to meet obligations on carbon emissions and adopting *"a precautionary approach to climate change by avoiding or minimising potential contributions to adverse change and incorporating measures which adapt as far as possible to unavoidable change"*. The explanation behind the policy is that it advocates using resources wisely to ensure that "*all development is compatible with environmental limits, including in regard to carbon performance, and that no development adversely affects the integrity of sites of European or international importance for wildlife*" (paragraph 3.9).

3.4.5 Policy SS2 (Overall Spatial Strategy)

Includes a requirement that LDDs should "adopt an approach to the location of major development which prioritises the re-use of previously developed land in and around urban areas to the fullest extent possible". Policy SS3 (Key Centres for Development Change) includes "*Thurrock urban area*" as one of the key centres such that "*Concentrating development at these locations will make the most of existing infrastructure and the potential for improvements or extensions to it*" (paragraph 3.13).

3.4.6 Policy SS5 (Priority Areas for Regeneration)

Refers to Essex Thames Gateway as one of the "*areas with generally weak economic performance and significant areas of deprivation*".

3.4.7 Policy SS8 (Urban Fringe)

Encourages *"the enhancement, effective management and appropriate use of land in the urban fringe."*

3.4.8 Policy SS9 (The Coast)

Provides, among other considerations, that the strategy should recognise, among others, the needs for environmental protection, the importance of the EER's ports and predicted sea level rises. LDDs should "*adopt policies which support the re-structure of coastal economies and the provision of jobs to satisfy local needs*" and ensure that new development is compatible with shoreline management so as to avoid constraining effective future flood management, or increasing the need for new sea defences and other long term flood management.

<u>Economic Development</u>

3.4.9 Policy E1 (Job Growth)

Contains indicative targets for net growth in jobs for the period 2001-2021 which indicates 55,000 jobs in Essex Thames Gateway, shared between Thurrock, Basildon, Castle Point, Southend-on-Sea, Rochford. Policy E2 (Provision of Land for Employment) requires LDDs to ensure that there is an adequate range of sites/premises to support the full range of sectoral requirements to meet the indicative job growth targets of Policy E1 which would include sections/clusters identified in Policy E3. Policy E3 (Strategic Employment Sites) requires that sites should be provided in various locations including "Thames Gateway linked to the strategies for the key centres at Basildon, Southend-on-Sea and Thurrock Urban Area". Policy E4 (Clusters) does not specify London Gateway by name but is clear that the list is not exclusive; it defines "*clusters*" as "*concentrations of companies in related activities …*"

(paragraph 4.14), it refers to transport gateways and renewable energy as a key sector, which is pertinent to London Gateway and the proposed GEC.

Culture

3.4.10 *Policy C1 (Cultural Development)*

Requires LDDs and wider strategies to include policies that support and grow the region's cultural assets; the preamble to this policy refers to various cultural assets, including archaeology and the historic environment.

Transport

3.4.11 *Policy T1 (Regional Transport Strategy Objectives and Outcomes)*

Contains a clear priority to "*increase passenger and freight movements by more sustainable modes*", while reflecting the functionality required of the region's transport networks; including the efficient use of existing transport infrastructure, increased movements by public transport, walking and cycling, sustainable access to areas of new development, increased movement of freight by rail and economic growth without consistent growth in traffic. These features will be evident in the site location as London Gateway develops.

3.4.12 *Policy T2 (Changing Travel Behaviour)*

Is about achieving a significant change in travel behaviour.

3.4.13 *Policy T6 (Strategic and Regional Road Networks)*

In a reference to the existing road network, supports "*the efficient movement of freight, which cannot be carried by rail or waterway, in such a way to minimise its impact on the environment and local transport networks*".

3.4.14 *Policy T9 (Walking, Cycling and Other Non-Motorised Transport)*

Requires pedestrians, cycle and other non-motorised forms of transport to be managed and improved to enhance residents access to work, etc.

3.4.15 *Policy T10 (Freight Movement)*

Identifies London Gateway as one of the region's major ports; it refers to priority being "*given to the efficient and sustainable movement of freight*".

3.4.16 *Policy T11 (Access to Ports)*

Recognises the importance of ports from the point of economic growth and regeneration.

3.4.17 *Policy T14 (Parking)*

Sees parking control as a constituent of managing transport demand and influencing travel change, alongside measures to improve transport accessibility, walking and cycling.

Environment

3.4.18 *Policy ENV1 (Green Infrastructure)*

Defines as protected sites, nature reserves, green spaces, waterways and green linkages which will be in settlements and surrounding areas proposed for regionally significant development.

3.4.19 *Policy ENV2 (Landscape Conservation)*

Refers to the region's nationally designated landscapes (the Broads, the Chilterns, Norfolk/Suffolk Heritage Coasts and Areas of Outstanding Natural Beauty, however these features are not in the vicinity of the Site.

3.4.20 *Policy ENV3 (Biodiversity and Earth Heritage)*

Affords the strongest levels of protection to internationally/nationally designated sites while requiring proper consideration of other habitats and species.

3.4.21 *Policy ENV6 (The Historic Environment)*

Requires plans to identify, predict, conserve and where appropriate, enhance the historic environment, its archaeology, historic buildings, places and landscapes.

3.4.22 *Policy ENV7 (Quality in the Built Environment)*

Requires high quality design of all new development, coupled to "*high standards of environmental performance*". New development should provide buildings of an appropriate scale, make efficient use of land, address crime prevention, community safety, public health, promote resource efficiency and sustainable construction, reduce pollution including noise and light and maximise physical, economic and community regeneration.

Carbon Dioxide Emissions and Renewable Energy

3.4.23 *Policy ENG1 (Carbon Dioxide Emissions and Energy Performance)*

Building on the Supplement to PPS1 Planning and Climate Change 2007 states that new development should be located and designed to optimise its carbon performance; accordingly LPAs should:

- *"Encourage the supply of energy from decentralised, renewable and low carbon energy sources and through Development Plan Documents set ambitious but viable proportions of the energy supply of new development to be secured from such sources and the development thresholds to which such targets would apply. In the interim, before targets are set in Development Plan Documents, new development of more than 10 dwellings or 1000 m^2 of non-residential floorspace should secure at least 10% of their energy from decentralised and renewable or low carbon sources, unless this is not feasible or viable; and*
- *Promote innovation through incentivisation, master planning and development briefs which, particularly in key centres for development and change, seek to maximise opportunities for developments to achieve and where possible exceed national targets for the consumption of energy. To help realise higher levels of ambition, local authorities should encourage energy service companies (ESCOs) and similar energy saving initiatives".*

Reference is made to the Supplement to PPS1, which makes clear that tackling climate change is a key Government priority for the Planning System (paragraph 9.2). It is suggested that policies should promote location and design of development which encourages incorporation of suitable technologies and reduce energy consumption and carbon emissions (paragraph 9.4).

3.4.24 *Policy ENG2 (Renewable Energy Targets)*

Requires that: "*The development of new facilities for renewable power generation should be supported with the aim that by 2010, 10% of the region's energy and by 2020 17% of the region's energy should come from renewable source. These targets exclude energy from offshore wind and are subject to meeting European and International obligations to protect wildlife, including migratory birds and to revision and development through the review of this RSS*." Efforts should be made to switch to energy produced from renewable and low carbon sources and to encourage the use of CHP, while ensuring security of supply (paragraph 9.5).

Water

3.4.25 Water resources are limited; there are supply-demand issues in parts of the region (paragraph 10.1).

3.4.26 Policy WAT4 (Flood Risk Management)

Identifies coastal and river flooding as a significant risk in parts of the region; the "*priorities are to defend existing properties from flooding and locate new development where there is little or no risk of flooding*". Among the requirements of the policy, LDD should only propose departures from the policy "*in exceptional cases where suitable land at lower risk of flooding is not available, the benefits of development outweigh the risks from flooding and appropriate mitigation measures are incorporated and require that sustainable drainage systems are incorporated in all appropriate developments*." Figure 10 (Flood Map) illustrates Flood Zone 3 (100 year fluvial/200 year tidal) include much of the river frontage land along the Thames. The EER vulnerability to flooding is increasing; where some flood risk is unavoidable, it must be considered all stages of the planning process (paragraph 10.13).

Essex Thames Gateway Sub Region

3.4.27 Essex Thames Gateway Sub Region (ETG) is described as "*the Essex part of the Thames Gateway Growth Area which is prioritised for urban regeneration under the Sustainable Communities Plan situated south of the A13 in Thurrock and A127 in Basildon, together with the Boroughs of Castle Point and Southend-on-Sea and London Southend Airport in Rochford District*" (paragraph 13.14). It is noted that "*Essex and Thames Gateway contains the biggest assemblage of port infrastructure in the region, mostly Port of London Facilities in Thurrock*" and that "*The London Gateway container terminal and supporting infrastructure is planned on the former oil refinery site at Shell Haven in east Thurrock*" (paragraph 13.17).

3.4.28 Policy ETG1 (Strategy for the Sub-Region)

Aims to achieve transformational development throughout the Essex Thames Gateway which plans to substantially increase the number of homes and jobs, give the area a more attractive image, significantly increase the overall value of the economy, enhance the education and skills base and protect the natural and historic environment.

3.4.29 Policy ETG2 (Thurrock Key Centre for Development and Change)

Identifies Thurrock Urban Area (Purfleet to Tilbury/Chadwell St. Mary) as a key centre for development and change and similarly.

3.4.30 Policy ETG3 (Basildon Key Centre for Development and Change, Policy ETG4 (Southend on Sea Key Centre for Development and Change) and. Policy ETG5 (Employment Generating Development)

Envisage that of the 55,000 net additional jobs planned for the ETG in the period 2001-2021, almost half (26,000 jobs) will be created within Thurrock (whole LA area). The policy includes several criteria; one is to provide for a range of sites/premises "*suitable for the needs of existing and future businesses, including the development at London Gateway…*". It is noted that "*The emphasis on improving skills and qualifications is particularly important in Essex Thames Gateway. Upskilling will also enable those residents who commute to London to contribute more to and benefit from growth in London's economy*" (paragraph 13.21).

3.5 Local Policy

Thurrock Borough Local Plan (1997) (TBLP)

Background

3.5.1 The Secretary of State made a direction on 20.9.07 under paragraph 1(3) of Schedule 8 to the PCPA that certain specified policies contained in the TBLP are to be "*saved*", among which some are relevant to the proposed GEC.

Land Use

3.5.2 The proposed Site is shown on the TBLP Proposals Map as being within an area to which *Policy E8 (Oil Refineries)* applies in respect of development for new oil refinery activities. This includes the former Shell Haven Oil Refinery site, now comprising the London Gateway development, within which the Application Site is located. London Gateway received planning permission from the Secretary of State in 2007 for commercial floorspace, comprising Classes B8, B2, B1. Although *Policy E8* is "*saved*", it has effectively been superseded by the approval of the LG Developmentwhich is recognised in the EEP. Accordingly the policy is not referred to in Appendix A.

3.5.3 There are no other TBLP designations directly affecting the Application Site, however the area north of Manor Way is subject to various designations including *Policy GBI (The Green Belt), Policy LN2 (Landscape Improvement Area), Policy LN3*

(Landscapes of Local Importance), Policy LN15 (Sites of Importance for Nature Conservation - SINC). There is further reference to these policies in paragraph 3.5.4. The Plan shows an area to the north of the *Policy LN15* designation as *Policy LN13 (Sites of Special Scientific Interest - SSSI)*; this policy is not "*saved*" but the area of SSSI is subject to statutory protection to which reference has been made in PPS9 (ES 3.3.7) and EEP Policy ENV3 (ES 3.3.1.7).

Built Environment

3.5.4 *Policy BE1 (Design of New Development)*

Requires a high standard of design in all new development with particular attention to mass, form and scale, the constituent elements of design, quality and appropriateness of materials, landscaping, treatment of spaces, vehicular and pedestrian access and the integration of development with its immediate surroundings and wider setting.

3.5.5 *Policy BE2 (Development Control Policies)*

Provides a link between the Part One policies and the annexes in Part Two, referred to earlier, which are considered necessary to achieve a satisfactory standard of development in the Borough.

3.5.6 *Policy BE4 (Landscaping)*

Seeks concurrent submission of landscaping details with applications; Policy BE10 (Infrastructure) - requires adequate infrastructure either to exist, or to be provided by the developer.

3.5.7 *Policy BE11 (Energy Efficiency)*

Provides that, in considering development, the Council will take into account the need for energy efficiency; the justification behind this policy is that the conservation of non renewable forms of energy is of major importance in creating sustainable development (paragraph 3.4.27).

3.5.8 *Policy BE26 (Development of Contaminated Land)*

Requires that when considering development, surveys will be required to demonstrate that remediation will enable reclamation.

Green Belt, Landscape, Nature Conservation

3.5.9 *Policy GB2 (Green Belt)*

Stipulates that planning permission "*will not be given except in very special circumstances*" for development.

3.5.10 *Policy LN2 (Landscape Improvement Areas)*

Expects "*sympathetic landscaping schemes in association with new developments*".

3.5.11 *Policy LN3 (Landscapes of Local Importance)*

Will only permit development "*if it would not cause permanent loss, or damage to, the character of the landscape*"; The area south of Corringham is one of several locations included in the policy for their contribution to the landscape generally.

3.5.12 *Policy LN12 (Development Proposals and Nature Conservation)*

Requires new proposals for development to give proper consideration to a site's nature conservation value, not to prejudice wildlife habitats and, where appropriate, to provide for new habitat creation.

3.5.13 *Policy LN15 (Sites of Importance for Nature Conservation – SINC)*

Requires that, in the areas identified, "*development will only be permitted which would materially harm their nature conservation value*".

3.5.14 *Policy LN16 (Areas of Local Nature Conservation Significance and Ecological Corridors)*

Requires that proposals for development should retain the nature conservation interest of all ecological corridors (including the River Thames) listed in Appendix 7 to the TBLP.

Employment

3.5.15 The background to the employment policies makes that point that Thurrock has a long tradition of industry, linked to its natural resources, including the development of docks and wharves to utilise the riverside location of the Borough. It is also noted that the industrial base had previously provided a large number of jobs but that, in more recent years, this has declined; the plan aims to accommodate a higher level of employment growth within the Borough, to diversify job types and employment (paragraph 7.3.5).

Transport

3.5.16 *Policy T1 (Balanced Transport Strategy)*

Encourages "*the greater use of alternative modes of transport*", including "*the provision of new and improved facilities and services for the movement of freigh*t."

3.5.17 *Policy T6 (Traffic Management)*

Facilitates, where necessary, the utilisation of traffic management to regulate the passage of vehicles.

3.5.18 *Policy T8 (Existing and New Public Footpaths) and Policy T11 (Cycleways)*

Promote greater use of public footpaths and cycle provision.

3.5.19 *Policy T18 (Railways – Freight Facilities)*

supports the use/re-use of railway freight facilities.

3.5.20 *Policy T20 (Waterways – Freight Facilities)*

Supports the use of the River Thames for the transport of goods and materials subject to there being adequate access on the landward side and satisfying environmental considerations.

Local Development Framework

Background

3.5.21 The Council's local development scheme (LDS) (July 2007) sets out its programme for the preparation of new local development documents (LDDs). The LDS is out of date; at the time that it was produced, it referred to the strategic framework being provided by RPG9; this was replaced in May 2008 by the EEP. Reference is made to saving of certain policies; in fact, many policies were subsequently "*saved*" on 20.9.07 by the direction of the Secretary of State under paragraph 1(3) of Schedule 8 to the PCPA 2004. The LDS refers to the deposit draft *Thurrock Unitary Development Plan Deposit Draft (TUDP) 2003* as a material consideration in the determination of planning applications, however the TUDP is no longer a planning consideration. The Statement of Community Involvement (SCI) (June 2007). Part Five, concerning planning applications, refers to TTGDC having become the LPA for planning applications for certain levels of development. The Council and TTGDC encourage all prospective applicants to engage with parties near to or affected by intended developments before submission of major and significant applications.

3.5.22 A Committee report of 27.1.10 requested the Council to agree to publication of the *Thurrock Core Strategy and Policies for Management of Development - Proposed Submission Draft Development Plan Document (DPD)* and subsequent submission to the Planning Inspectorate and the Secretary of State. Interested persons are invited to make their views known on the soundness of the policies through submission to the Council of formal representations.

3.5.23 In Chapter 4 Spatial Policies, *The Thurrock Economic Development Strategy (2009) (TEDS)* focuses future growth on the existing core economic sectors and the identified growth sectors comprising the international port related facilities at Tilbury, the deep water port at London Gateway and the logistics and retail clusters at

Lakeside/West Thurrock Basin. The TEDS seeks to reduce dependency by diversifying the economy in a manner that will not impact on the area's core sectors or create barriers to their continuing development. It suggests that the growth sectors identified by the TEDS could offer additional sources of new employment and contribute to economic diversification, of which one is "energy" (paragraphs 4.11/12). *Policy CSSP2 (Sustainable Employment Growth)* includes a table of Key Economic Strategic Economic Hubs, Core and Growth Sectors and Flagship Developments. For London Gateway, it refers in Core Sectors to port, logistics and transport; in Growth Sectors to environmental technologies, recycling and energy; in Flagship Developments to training, innovation & research facility, business and distribution park and renewable energy centre; in Indicative Job Growth to 11,000-13,000 jobs.

3.5.24 Chapter 5 contains a number of thematic policies including Core Strategic Employment Policies, Core Strategic Transport and Access Policies, Core Strategic Environment Policies, Core Strategic Climate Change Policies, Core Strategic Water, Riverside and Coastal Policies and Core Strategic Infrastructure. *Policy CSTP25 (Addressing Climate Change)* refers to priorities which include reducing CO_2 and N_2O emissions from the industrial/commercial sector, particularly from gas/electricity consumption (paragraph 5.13.2); increasing renewable energy generation, ensuring new design incorporates energy/water efficiency, climate change resistant features and flood risk. *Policy CSTP26 (Renewable or Low-Carbon Energy)* encourages opportunities to generate energy from non-fossil fuel and low carbon sources and will promote and facilitate proposals for centralised forms of energy generation at appropriate locations, including London Gateway.

3.5.25 Chapter 6 includes a number of development policies which address Built Environment, Natural Environment, Transport and Access, Climate Change, Flood Risk, Developers Contributions. *Policy PMD13 (Decentralised Renewable and Low-Carbon Energy Generation)*, as background, aims for decentralised energy to be supplied from local renewable and low-carbon sources, to increase the proportion of renewable and low-carbon energy generation, reduce the consumption of fossil fuels and the low-carbon footprint. The policy requires new development of 5 or more residential dwellings, or 1 000 m^2 or more of non-residential floorspace to secure as a minimum the following proportions of predicted energy from decentralised and renewable or low-carbon sources, unless it can be demonstrated that it is not feasible, namely 10% from 2010, 15% from 2015 and 20% from 2020. The Council will require higher targets on priority sites identified in an Energy Study to be completed by Summer 2010.

Thurrock Thames Gateway

3.5.26 Among the various documents produced by TTGDC, the following are of some relevance:

- A Framework for Regeneration and Sustainable Growth 2005
- 2 Year Corporate Plan 2006/07 - 2007/08 2006
- Thurrock Spatial Plan 2007 2007
- East Thurrock Master Plan 2009

3.5.27 The "*Framework for Regeneration and Sustainable Framework*" refers to TTGDC's broad statutory objective from which it has developed a number of corporate aims to:

- Improve the supply of housing;
- Generate jobs and diversification of employment;
- Develop skills;
- Balance the social structure of the Borough;
- Improve infrastructure and transport access; and

- Improve the quality of the environment and public realm.

These have been translated into a series of strategic objectives, which include riverside regeneration, employment innovation and economic development and port(s) logistics and distribution (paragraphs 1.10, 1.11).

3.5.28 The Framework identifies nine cross cutting strategic goals to deliver the Thames Gateway sustainable communities and population and economic growth agenda, reflected in Government policy and in the then emerging RSS (EEP was published in 2008) (paragraphs 3.57-3.66): Of the nine goals, the following are relevant:

- *Contribute to the provision of sufficient capacity to meet strategic growth targets including 26,000 new jobs and 18,500 new homes in a sustainable way by 2021* (item 1);
- *Increase participation and attainment in life long education and skills development* (item 2);
- *Create a wide range of jobs with a future* (item 3); and
- *Ensure that development and regeneration take place in an environmentally sensitive way* (item 9).

Against the background of these policies, one of the priorities is that "*Thurrock has long been a home for power generation and the infrastructure can now be utilised by renewable energy production on a large scale*" (paragraph 4.73).

3.5.29 The "*2 Year Corporate Plan*" states that "*The Corporation's strategy to regenerate Thurrock is economic and employment led*" (paragraph 4.1) and that in considering how to deliver the 26,000 jobs, target for Thurrock, the Corporation strongly supports the "*Shell Haven*" proposals (now London Gateway) (12,000 jobs over the next 15 years).

3.5.30 The "*Thurrock Spatial Plan*", which sets out the amount and broad locations of development, draws on the earlier Regeneration Framework which set the future direction for regeneration in the area and provided the basis to develop projects and a work programme (page 12). The regeneration of Thurrock is to be led by growth in the number and diversity of jobs, with the main locations for jobs growth being centred on the five hubs of Purfleet, Lakeside Basin/West Thurrock Riverside, Grays Town Centre, Port of Tilbury and the proposed London Gateway (page 23).

3.5.31 The *"East Thurrock Master Plan"* has been prepared by TTGDC to guide the growth of East Thurrock to 2021; the Plan area includes Corringham, Stanford-le-Hope and the employment areas to the east. Broad strategic themes of the Plan include generating jobs and diversifying employment, enhancing the potential of the LG Development, improving the supply of housing, developing and enhancing skills, balancing the social structure, improving transportation, improving design/quality of the public realm and enhancing cultural life. The Plan reaffirms the employment targets for Thurrock (26,000 jobs) and the LG Development (approximately 11,500 jobs). Reference is made to the Council's Thurrock Economic Development Strategy 2008 which supports maximising employment opportunities and investment in target growth areas, including generating a stronger skills base and improving the inward investment offer.

3.5.32 TTGDC Draft Planning Obligations Strategy (March 2009) was prepared for public consultation which has now ended. The draft strategy was presented to the TTGDC Board in December 2009 which agreed that, subject to minor modifications, approval of the amended strategy would be delegated to the Chair and Vice-chair of the Board and the Director of Planning and Strategy; the final document is yet to be published. The draft strategy summarises advice in Circular 05/2005 with regard to the powers given to LPAs to secure contributions under Section 106 TCPA (S106). It explains that because TTGDC is not the plan making authority the final strategy will not be a statutory document, however it will form part of TTGDC's Regeneration Framework and will be afforded weight as a material planning consideration to help guide negotiations on S106 agreements (paragraph 2.2.3). The draft strategy sets out the level of growth expected in Thurrock in terms of new floorspace provided by residential and non-residential development; the latter is described as mainly comprising *"employment uses, including industrial, commercial and retail development"* (paragraph 3.2(4)). It then provides a list of the type and amount of infrastructure required to match the expected growth and identifies which of these might appropriately be included in a *"standard charge"* to be applied to new development (Table 3.7); Table 3.15 sets out the standard charges per dwelling and per m^2 of commercial floorspace for the relevant infrastructure components. The draft strategy acknowledges the need to test financial viability principally in relation to private residential development but also mentions appraisals of office, industrial and retail developments. As a result of the viability analysis, the draft strategy suggests that the 'standard charge' should be discounted for residential and commercial developments to reflect the fact that *"planning contributions alone cannot meet the full cost of all infrastructure required to support development"* (paragraph 5.2.1). It concludes that *"Planning obligations for all other types of development that fall to TTGDC to determine should continue to be negotiated on a scheme-by-scheme basis, taking account of the nature of the proposed development, site circumstances and the need to manage any potential impacts of the development"* (paragraph 5.2.3).

SECTION 4

DESCRIPTION OF GEC

4 DESCRIPTION OF GEC

4.1 GEC Application Details

4.1.1 GECL seeks consent principally for:

- 2 No. gas turbines
- 1 No. or more steam turbines
- 2 No. heat recovery steam generators (HRSG)
- 1 No. or more auxiliary boilers
- 2 No. stacks
- Air cooled condensers (ACC) and auxiliary cooling
- 2 No. or more transformers
- Gas receiving facility
- Other plant and equipment
- Water treatment plant
- 1 No. or more Demineralised Water Storage Tank / s
- 1 No. Raw/Firewater Tank
- 1 No. or more switchyard / s
- Buildings (including administration offices, workshop, warehouse, control room, engineering works including contractors temporary laydown areas, vehicle loading / unloading / fencing, roads, storage facilities, lighting)
- Ancillary plant and equipment.

In addition to the above, landscaping and biodiversity provision and storm water ponds may be incorporated into the scheme

4.1.2 GEC Site Location

4.1.3 The location of the GEC site is shown in Figure 1.1. The Ordnance Survey (OS) Grid Reference of the centre of the site is approximately 573209, 182165.

4.1.4 Whilst the application site boundary for GEC incorporates areas to the north and west which may be used for temporary laydown during construction, overall approximately 29.1 hectares (71.9 acres), once constructed the GEC site will be approximately 11.3 hectares (28.0 acres) in size. The GEC site includes the land to be set aside for the purposes of installing carbon capture equipment if required in the future.

4.1.5 The GEC site is situated on the north bank of the Thames Estuary and lies approximately 6 km east of the A13. The A1014 dual carriageway (The Manorway) lies to the north of the site and runs east to west to provide a link with the A13, which in turn links in with the M25 at Junction 30.

4.1.6 The nearest residential settlements are at Corringham and Fobbing which lie approximately 4 km to the west, Canvey Island which lies approximately 5 km to the east, and Basildon which lies approximately 7 km to the north.

4.1.7 To the east of the GEC site lies the existing Coryton CCGT Power Station (700 m east), and the existing Coryton Oil Refinery (950 m east).

4.1.8 GEC will be located on land within the LG Development. Further discussion of the GEC site and its surroundings, including the LG Development, is provided in Section 5.

4.2 Operation of GEC

4.2.1 GEC will burn natural gas only, which is an inherently clean fuel.

4.2.2 GEC will provide up to 900 MWe of power generation capacity. This will include the provision of up to 150 MWe to the LG Development, which is expected to meet their long-term electricity requirements.

GEC Configuration

4.2.3 The configuration of GEC will likely comprise two gas turbine units, fuelled by natural gas. Each unit will comprise a gas turbine and a heat recovery steam generator (HRSG) which will provide steam to steam turbine equipment. There may only be one common steam turbine rather than one per gas turbine.

4.2.4 As such there are currently two typical layout options which are considered in relation to GEC. These are the single-shaft and the multi-shaft unit layouts. The principal difference between these two layouts is that the multi-shaft uses one large steam turbine, whereas the single-shaft option uses two smaller steam turbines.

4.2.5 The proposed layouts are shown in Figure 4.1 (single shaft), Figure 4.2 (multi shaft) and a parameter block model layout is shown in Figure 4.3.

4.2.6 Under both single and multi-shaft layouts options the total electrical output of GEC will be approximately 900 MWe at typical site ambient conditions. However, the final electrical output of GEC will be dependent upon the final technology and manufacturer choice.

Process Description

4.2.7 The natural gas will be burnt in the combustion chamber of each gas turbine from where the hot gases will expand through the gas turbine, which in turn drives an electrical generator, to generate electricity. Each gas turbine will comprise an inlet air filter, an air compressor, combustion chamber, power turbine and exhaust silencer.

4.2.8 The hot exhaust gases still contain recoverable energy and will therefore be used in a heat recovery steam generator (HRSG) to generate steam. The high-pressure steam produced will be used to drive steam turbine equipment to generate additional electricity.

4.2.9 The use of a combined gas and steam cycle increases the overall efficiency of the unit. As such, GEC will be capable of generation in combined cycle mode with an overall electrical generation efficiency of approximately 55 per cent based on the lower calorific value (LCV) of the fuel. If it becomes technically and economically feasible to provide heat and / or power to surrounding facilities / customers, additional fuel utilisation gains may be achieved.

4.2.10 The spent steam leaving the steam turbine equipment will pass to an air cooled condenser where it will be condensed. The resultant condensate will be returned to the HRSGs for re-use minimising water usage.

4.2.11 Figure 4.4 shows a schematic representation of the CCGT principle.

4.2.12 The use of ACCs, rather than a wet cooling system, has the following benefits:

- No visible cooling tower plumes;
- Significantly lower water consumption; and
- No surface water abstraction or discharge of heated cooling water to water courses.

4.2.13 The steam turbine system will comprise of the turbine equipment itself, a multi-cell air cooled condenser and condensate extraction pumps and air extraction equipment.

4.2.14 Natural gas is a clean fuel and does not produce the particulate or sulphur emissions associated with burning coal. As a result, flue gas cleaning equipment is not required as all atmospheric emissions from the plant will be controlled at the source.

4.2.15 The gas turbines to be selected for installation at GEC will be equipped with proven pollution control technology, which will limit the production of NO_x to a maximum of 50 mg/Nm^3 (at reference conditions, as required by the LCPD when gas turbine outputs are above 70 per cent load. During times where supplementary (duct) firing is used, the NO_x emissions level may increase slightly, but should be no more than 64.4 mg/Nm^3.

4.2.16 The technique, known as Dry Low NO_x (DLN) combustion, represents the Best Available Technique (BAT) for limiting emissions of NO_x to the atmosphere from gas turbine based power stations.

4.2.17 Modern firing controls will be used, enabling combustion to be optimised for all operating conditions.

4.2.18 Back-up firing on distillate fuel oil (DFO), or any other oil, is not proposed.

4.2.19 The gas turbines will be situated inside integral acoustic enclosures designed to ensure that noise levels generated by the plant are within acceptable limits. Additionally, the gas and steam turbine equipment and generators will all be enclosed in steel framed buildings to further mitigate noise levels emanating from the GEC site.

Plant Dimensions

4.2.20 Table 4.1 identifies the main structures and plant to be located at the GEC site, and provides estimates of the expected approximate dimensions. These are shown in the parameter block model layout as shown in Figure 4.3. However, as the detailed design of GEC will not be completed until a construction contract is in place, it should be noted that the exact dimensions cannot be identified and therefore a degree of flexibility of these dimensions is required. The exact dimensions will be agreed with TTGDC prior to the commencement of construction.

TABLE 4.1: ESTIMATED MAIN STRUCTURE / PLANT ITEM DIMENSIONS

Structure / Plant Item Include	***Height (Up To) (m)***	***Area (m^2)***
Gas Receiving Facility (Orange Area) • Gas Receiving Facility	14	6 080
Water Storage Tanks (Brown Area) • Demineralised Water Storage Tank • Raw / Firewater Tank • Water Treatment Plant	23	11 600
Administration Block (Pink Area) • Warehouse, Maintenance, Admin and Control Building • Car Parking	17	6 870
Main CCGT Plant (Blue Area) • Gas Turbine Area • Heat Recovery Steam Generator • Steam Turbine Area • Transformers • Air Cooled Condensers	42	41 600
CCS Area / Temporary Laydown (Green Area))	-	47 100
Stacks (Black striped Area within the Blue Area)	75	Within Main CCGT Plant

4.2.21 The remainder of GEC will consist of air compressing equipment, electrical switchgear and control equipment. The majority of the remaining plant and equipment will be housed in relatively low buildings, of the order of 5 to 10 m in height. The GEC site will be surrounded by securing fencing.

4.2.22 GEC will be designed so as to be CCR. An area of land within GECL's control and within the GEC site has been identified to allow for the retrofitting of a carbon capture plant in the future. This area of land is approximately 4.7 ha.

4.2.23 This area can be seen coloured green in both the layout options shown in Figure 4.1 (single shaft) and Figure 4.2 (multi shaft), and in the parameter block model shown in Figure 4.3.

4.2.24 As per the requirements of DECC, a CCR Feasibility Study has been undertaken for GEC. Further details on this are provided in Section 8, and in the stand-alone CCR Feasibility Study.

Interconnections

4.2.25 The natural gas used as the fuel will most likely be taken from a new lateral pipeline to be constructed from the National Grid National Transmission System (NTaS) No. 5 Feeder pipeline. Whilst this consent application includes for an on site gas receiving facility, a separate consent application will be submitted for the underground gas pipeline in due course.

4.2.26 The quality of the natural gas will be the same as that used in domestic properties and will be supplied to a flanged terminal point at a pressure in the range of approximately 30 to 75 bar(g). There will be gas pressure reduction / and potential for compression facilities on the GEC site to regulate the pressure of the incoming gas supply to that required by the gas turbines, which are yet to be selected.

4.2.27 With the exception of temperature and pressure regulation, the natural gas will not be treated on site and accordingly natural gas will not be stored on the GEC site. An indicative Calorific Value of the natural gas is 36.9 MJ/m^3.

4.2.28 Further information on the gas pipeline routing is provided in Section 6.

4.2.29 The electricity generated at GEC will most likely be dispatched to the High Voltage (HV) National Grid system via a new HV underground cable, an overhead line or a combination of both to a new substation to be constructed by National Grid most likely at Mucking Flats. The feasibility study found that the most likely connection would be via an underground cable (due to spatial constraints) to a point north of the A1014 (The Manorway) Road and then via an over ground connection to the proposed National Grid substation, most likely at Mucking Flats. This option has been identified as having the least environmental impact. It is however important to note that this route is the subject of on going studies. A separate consent application will be subsequently submitted for the HV cable / a new over head line connection in due course. National Grid will be responsible for locating and permitting the new substation.

4.2.30 Further information on the HV underground cable / overhead line routing is provided in Section 6.

4.2.31 Interconnections and easements may also be required for CHP (for the export of steam / hot water) and CCR (for the export of captured CO_2). These exports are discussed further in the CHP Assessment and CCR Feasibility Study respectively.

Plant Performance

4.2.32 It is expected that for the majority of its life, GEC will operate in various running modes including full load (maximum continuous rating) and cycling.

4.2.33 GEC will occasionally be shut down for periods of essential maintenance and statutory inspections. Minor outages (of the order of 4 days) are expected to occur every year. Major outages (of the order of 4 weeks) are expected to occur every three years. Major plant maintenance shut downs will be planned on a long-term basis with intermediate stoppages being infrequent and of short duration only.

4.2.34 In the event of a gas turbine or HRSG trip, GEC will shut down in an orderly manner. In the event of a steam turbine trip the gas turbine will shut down in an orderly manner.

4.2.35 Based on operational details from the CECL Power Station, it is likely that in a non-major outage year GEC will have an annual average availability of the order of 96 per cent based on the expected scheduled maintenance regime but not including any forced outage periods.

4.2.36 The operational life time of GEC will be of the order of 35 years.

4.2.37 Plant performance will be continuously recorded to ensure correct and efficient operation of GEC. Any significant deviations will be alarmed and corrections carried out on occurrence. Records will be maintained of performance and deviation.

4.2.38 GEC will be designed with a view to a high degree of automatic operation. However, operator intervention will be necessary from time to time. Full facilities for interfacing information and control and alarm systems will be installed so that GEC can be operated from the central control room via the distributed control system (DCS).

Miscellaneous Operating Materials

4.2.39 Storage for chemicals will be provided in appropriately bunded and secure areas within the on site stores.

4.2.40 Lubricating oils will be supplied to the gas and steam turbine equipment and generator bearings and will also be supplied for the turbine control and hydraulic oil systems. The lubricating oils will be stored on the GEC site within tanks in an impermeable bund sized to contain 110 per cent of the contents of each tank, in line with the Oil Storage Regulations[5].

4.2.41 Used lubricating oils will also be stored on the site for re-use or will be disposed of off-site by an approved and licensed contractor in accordance with applicable regulations.

4.2.42 Transformers will be provided on site to allow the plant to receive electrical supplies from the wider national grid. All transformers will be oil filled and each transformer will be provided with a containment bund that will be capable of containing 110 per cent of the oil content of the transformer, in line with the Oil Storage Regulations.

4.2.43 Pumps will drain the oil sumps to an oil separator which in turn will discharge to the site drainage system. The sumps will be installed with high level alarms to avoid overflow.

4.2.44 A demineralised water storage tank will be provided on the GEC site to provide deionised water for the proposed HRSGs. The deionised water for this tank will be supplied from the water treatment plant.

4.2.45 A compressed air system will be provided to compress and deliver air of a quantity and quality suitable for all general, instrument and control purposes at all appropriate points in GEC.

4.2.46 Storage facilities will also be provided for the small quantities of sodium phosphate, oxygen scavenger, ammonia and other chemicals used in boiler water dosing. All such chemicals will be retained in suitable containment areas on the site. The boiler dosing chemicals and dosing systems will be shielded from the atmosphere. Air discharged from the ammonia and other process dosing chemicals will pass through a device such as a common water seal and an active carbon filter where appropriate to avoid the uncontrolled release of these chemicals to the atmosphere.

4.2.47 Miscellaneous materials such as oils, greases, cleaning substances and materials, laboratory chemicals etc, will be stored in suitable storage conditions or containers on the site.

4.2.48 Sewage effluent will be treated by an individual onsite sewage treatment plant.

[5] *The Control of Pollution (Oil Storage) (England) Regulations 2001*

4.2.49 All storage facilities will be designed, situated and used in compliance with Control of Substances Hazardous to Health (COSHH) Regulations 2002. There will be no substances stored on the GEC site that will make the site notifiable to the Health and Safety Executive (HSE) under the Control of Major Accident Hazards (COMAH) Regulations 1999.

4.2.50 Sufficient spares will be held at GEC to ensure reliable operation of the plant. The design of buildings, enclosures and equipment will also minimise regular and long term maintenance.

4.2.51 Materials and finishes will be selected to meet this objective and to ensure that the appearance of GEC does not deteriorate materially over its operating lifetime (approximately 35 years). Materials and finishes will be similar to those used on existing CCGT Power Stations, and will be selected to be sympathetic the appearance of the surrounding LG Development. This is considered within the stand alone Design and Access Statement that accompanies the application.

Waste Materials

4.2.52 A feature of the gas turbine technology, on which GEC is based, is that waste generated should be minimal and restricted to the following:

- General office wastes;
- Used gas turbine air intake filters (typically replaced annually);
- Separated oil / sludge from oil / water separators; and
- Used oil, chemicals or chemical containers.

4.2.53 Other wastes would be returned to the original supplier where possible or removed by an appropriate licensed contractor.

Safety and Emergency Plans

4.2.54 The hazards associated with CCGTs have been studied over many years and a considerable amount of design and procedural experience has been built up in this area.

4.2.55 The design of GEC will incorporate all the features needed to comply with relevant safety regulations. The HSE will also be consulted with regard to safety issues associated with GEC.

4.2.56 GECL will take into account and comply with all UK Statutory Regulations including in particular:

- The Health and Safety at Work Act 1974;
- The Electricity at Work Regulations 1989; and
- The Construction (Design and Management) (CDM) Regulations 2007.

4.2.57 Additionally, GECL will take into account and comply with any other standards and Codes of Practice relevant to GEC.

4.2.58 Control facilities will be provided on the GEC site. One or more emergency diesel generators will be installed to provide emergency back-up and enable GEC to be shut down in a safe manner in the event of loss of electricity. It is expected that these engines would only ever be operated for testing purposes and only for very short durations.

4.2.59 Fire protection and detection systems will be provided throughout the GEC site as is the case with the existing CECL Power Station.

4.2.60 A comprehensive fire protection system will be installed to cover all equipment on the GEC site that could constitute a fire risk. For the protection of equipment within each gas turbine package, where water spray will cause damage, a total flood CO_2 system will be used. An automatic high velocity water spray system for the protection of the turbine lubricating oil tank, coolers and associated pipework or similar system will also be provided.

4.2.61 A fire detection system, incorporating heat sensors, will be used in conjunction with automatic spray nozzles and smoke detectors. Non-combustible and fire resistant building materials will be utilised. Continuous natural gas monitoring systems will be provided. Venting systems will be designed to prevent explosion of air / gas accumulations. Ignition sources will be protected from damage through their design. Testing of fire protection systems will be carried out in accordance with a Safety and Emergency Plan.

4.2.62 Additionally the fire protection and detection systems will include fixed water protection systems, fire alarms and typical portable appliances. Fire water will be stored in a dedicated fire water tank on the GEC site.

4.2.63 GEC will employ conventional protective features, including emergency relief valves, shut down sequence interlocks, safety interlocks, fail safes, detection and alarm systems, mechanical and electrical protective devices. There will be back up systems and protective measures to deal with emergency situations such as electrical power failure, water supply failure, compressed air failure, major equipment failure and lightning strikes.

4.2.64 There will be appropriate means of drains within the various storage bunds and all valves and couplings will be within the bunded area. In the event of leakage or spillage from any oil storage tank any oil will be contained within the bund surrounding the tank. Any oil found in a bund will be removed for disposal to a licensed site.

4.2.65 However, an oil spill or chemical spill is recognised as being the principal environmental emergency that could arise at GEC. As such, emergency response plans will be produced for GEC and will cover the following:

- Emergency procedures for chemical tanks; and
- Emergency procedures in the event of a spill of lubricating oil.

4.2.66 Access to the GEC site will be strictly controlled. Security of the GEC site will be achieved by providing suitable fencing to the site perimeter and the use of security cameras.

4.2.67 There are two sites in the immediately vicinity of the plant that give rise to Prenatal Attachment and Healthy Development Intervention (PAHDI) consultation zones. These are the tank farm c. 150 km to the north east and the oil refinery located some 950 km to the north east. The location of the GEC site is such that whilst the plant and associated buildings do fall within the consultation zones for these sites they are not located within distance that would prohibit the development of the GEC site for the intended use as a power generating facility.

4.3 Construction of GEC

Construction Environmental Management Plan

4.3.1 The construction contractor will be required to prepare and implement a Construction Environmental Management Plan (CEMP).

4.3.2 The purpose of the CEMP is to:

- Provide a mechanism for ensuring that measures to prevent, reduce and, where possible, offset potentially adverse environmental impacts identified in this ES are implemented;
- Ensure that good construction practices are adopted and maintained throughout the construction of the proposed development;
- Provide a framework for mitigating unexpected impacts during construction;

- Provide assurance to third parties that their requirements with respect to environmental performance will be met;
- Provide a mechanism for ensuring compliance with environmental legislation and statutory consents; and
- Provide a framework against which to monitor and audit environmental performance.

4.3.3 As such, the CEMP to be prepared and implemented for GEC will ensure work is completed in accordance with:

- The conditions of consent for GEC;
- GECL's contractual requirements;
- Any environmental or other codes of conduct required by InterGen;
- Relevant GEC-specific mitigation measures; and
- Current best practice.

Site Preparation

4.3.4 Further studies examining soil properties will be undertaken by the construction contractor, building on the results of site investigations carried out for GEC, and the surrounding LG Development, as reported in this ES and including any such investigative work undertaken subsequently.

4.3.5 In advance of any construction works a program of remediation is to be undertaken across the GEC site. Remediation Validation Reports will be produced as documentation of the works undertaken.

4.3.6 In addition, the potential exists for possible off-site contamination to migrate onto the GEC site during construction. As such, the construction contractor will conduct a contaminated soil survey and maintain a close watch for possible contamination appearing during construction. In addition it will be necessary to undertake piling for some of the foundations where the heavier plant equipment will be located.

4.3.7 Site preparation work may comprise the raising of the GEC site (potentially further than that undertaken for the surrounding LG Development), earthworks, and the excavations for foundations.

4.3.8 Trenching, installation of underground services and provision of temporary construction facilities including car parking facilities, storage / laydown areas and services will then take place.

4.3.9 It is likely that piling will be required for the majority of the heavy equipment including, but not limited to, the gas turbine area, HRSG area, steam turbine equipment and generator area foundations due to the heavy loading and the tight tolerance on settlement.

4.3.10 Throughout the duration of the construction period, there will be a dedicated area set aside for the temporary laydown and storage of plant equipment. This will most likely comprise an area comprising the land set aside for CCR (as shown in Figure 4.3) or be an appropriate area within the area to the north or west of the GEC site (as shown in Figure 4.5. This area will be available temporarily for any fabrication which may be necessary for construction works. An area within the temporary laydown and storage area will also be set aside for temporary car parking and office accommodation. All necessary measures will be taken to return the temporary laydown and car parking areas to their previous state, on completion of the construction phase as appropriate.

4.3.11 The programme for the mechanical and electrical works activities during the construction phase of GEC can be considered in terms of the following activities:

- Power plant erection;

- Power plant commissioning;
- Plant take-over;
- Power plant commercial operation; and
- Guarantee period.

4.3.12 The construction period will be of around 28 to 36 months duration, including commissioning.

4.3.13 The connection offer from the National Grid Company (NGET) is such that construction of GEC would likely commence in 2012. The construction workforce will peak at about 600 personnel. The target date for full operation of GEC is 2015. The direct operational workforce would be of the order of 15 to 25 personnel if operated in conjunction with the existing CECL Power Station, or up to 40 direct personnel if GEC is operated on a stand alone basis. Experience at the existing CECL Power Station suggests there could be of the order of 10 to 15 additional indirect jobs at the site. There will also be additional indirect jobs for contracted engineering staff during maintenance shutdowns.

4.3.14 Initially and until the buildings are closed and capable of providing an 'indoor working environment', construction work will only take place during Monday to Saturdays 07:00 – 19:00 hours.

4.3.15 No work on any Sunday or Bank Holidays will be undertaken, unless such work is associated with an emergency or does not cause existing ambient noise levels to be exceeded at nearby Noise Sensitive Receptors (NSR).

4.3.16 Should a need arise, due to technical constraints or similar, with regard to carrying out certain construction work outside the time indicated above, prior written approval from Thurrock Borough Council (TBC) (as the relevant Health Authority) will be sought.

4.3.17 Commissioning of each CCGT unit will take of the order of 16 weeks. This will be progressive from final erection checks, pre-commissioning and setting to work of individual component parts through to the overall testing to prove the technical acceptance of GEC. Tests on completion will demonstrate the fitness for purpose of GEC prior to commercial operation.

4.3.18 Performance tests will demonstrate that GEC complies with the performance guarantees. Reliability will be demonstrated by operating GEC under commercial conditions for a period without major repair to any item of plant or equipment.

4.4 Decommissioning of GEC

4.4.1 At the end of the useful life of GEC (around 35 years from commencement of operations), GEC will be decommissioned in accordance with legislative guidelines current at that time.

4.4.2 Alternatively, if market conditions and / or electricity supply constraints at that time indicate that it would be appropriate to extend the life of GEC, then decommissioning may be deferred to a later date. In order to ensure continuing adequate plant conditions and environmental performance, GEC would be re-engineered and re-permitted as required, dependent on the legislative requirements at that time.

4.4.3 Independently validated plant closure / demolition methodologies have been developed for power plants that are at the end of their useful life. The methodology covers demolition of the plant and buildings and removal of any contaminated and hazardous material from the site. When demolishing the power plant, it will be a matter of policy to ensure that the site is left with no environmental or safety risks.

4.4.4 Decommissioning will be in accordance with the requirement of GEC's Environmental Permit (EP) under the Environmental Permitting (England and Wales) Regulations 2007. Details of the decommissioning will be included in the site closure plan which has to be included as part of GEC's EP Application (which will be submitted to the EA at the same time or shortly after the Section 36 consent application is submitted to the Secretary of State for DECC).

4.4.5 In order to facilitate decommissioning, much of the plant on site will be made of materials suitable for recycling. For example, a large proportion of the buildings will be constructed of pre-fabricated steel and will therefore also be of interest to scrap metal merchants.

4.4.6 After the removal of the main items of plant and steel buildings, the remaining buildings will be demolished to ground level. All underground structures will either be removed or made safe. All deconstruction material to be removed offsite will be sent to a licensed waste management facility.

4.4.7 The decommissioning phase is likely to take place over several months.

4.4.8 The results of the pre-construction contaminated land survey will be used as a basis for a further contaminated land survey to be performed when GEC is closed to assess whether or not any contamination of the site has taken place during the lifetime of GEC. The GEC site will be returned to a condition suitable for reuse.

4.4.9 A full environmental departure audit will be carried out prior to decommissioning. This will examine, in detail, all potential environmental risks existing at the GEC site and make comprehensive recommendations for remedial action to remove such risks. Following completion of the demolition, a final audit will be carried out to ensure that all remedial work has been completed. The audit reports will be made available to future users of the GEC site.

4.4.10 Prior to decommissioning GEC, the EA will be notified as to the date of the closure and the results of the departure audit submitted.

4.4.11 During decommissioning all reasonable measures required to prevent any future pollution of the GEC site will be carried out. This will include measures such as:

- The emptying / cleaning and removal of storage tanks; and
- The removal from site of all materials / liquids liable to cause contamination.

4.4.12 The surface water drainage system for GEC will continue to operate throughout the decommissioning phase. Any areas where oil spillage could occur will continue to drain to an oil interceptor, which will continue to be maintained.

SECTION 5

DESCRIPTION OF THE GEC SITE AND ITS SURROUNDINGS

5 DESCRIPTION OF GEC SITE AND ITS SURROUNDINGS

5.1 The GEC Site

5.1.1 GEC will be located on the land within the LG Development, which is currently in the early stages of construction.

5.1.2 The LG Development is being promoted by DP World.

5.1.3 The GEC site will be levelled and provided to GECL in a condition that would allow for construction of GEC.

5.1.4 As such, there are two baseline conditions which are used in this ES to describe the baseline conditions of the GEC site. These include an existing baseline which describes the conditions pre-works for the LG Development and a future baseline which describes the conditions post-works for the LG Development.

Existing Baseline at the GEC Site

5.1.5 The landform within the LG Development is predominately flat and low-lying, with the north western part of the site rising gently toward Corringham and Stanford-le-Hope. Land levels are generally between +2 and +3 m Above Ordnance Datum (AOD), with a high point of +20 m AOD near Corringham.

5.1.6 In the south of the LG Development (in the Port area) levels are generally +2.7 m AOD. To the western edge of the existing sea wall the land rises to +6.1 m AOD. To the eastern edge of the sea wall, the land is approximately +5.0 m AOD.

5.1.7 Future details of the existing baseline at the GEC site which are relevant are provided in the specific impact Sections of this ES.

Future Baseline at the GEC Site

5.1.8 In advance of any construction works a program of remediation is to be undertaken across the GEC site. This clearance will be undertaken under the powers afforded to LG under their various consents for the LG Development.

5.1.9 As such, the future baseline at the GEC site will be ready for use for the purposes of the GEC Development.

5.1.10 Future details of the future baseline at the GEC site which are relevant are provided in the specific impact Sections of this ES.

5.2 The London Gateway Development

5.2.1 The LG Development will involve the re-development of the former Shell Oil Refinery site at Shell Haven near Corringham and Stanford-le-Hope (Essex) together with associated transport connections, reclamation of part of the foreshore of the River Thames Estuary, and dredging of higher parts of the navigation channel within the Estuary to accommodate the passage of the largest container vessels.

5.2.2 Once complete the LG Development is expected to become the most advanced deep-sea container Port in the UK, capable of handling approximately three and a half million cargo containers annually. The LG Business and Logistics Park will serve the Port and offer some nine million square feet of advanced business space for distribution and manufacturing companies.

5.2.3 The wide-ranging scale of the LG Development is such that a wide variety of consent applications were required. Applications made for the London Gateway development to date include:

- A Harbour Empowerment Order (HEO) under the Harbours Act 1964 associated with the proposed Port;
- An Outline Planning Application (OPA) under the Town and Country Planning Act 1990 for the proposed LG Business and Logistics Park; and

- A Transport and Works Act Order (TWAO) under the Transport and Works Act 1992 for the proposed rail improvements associated with the proposed LG Logistics and Business Park.

5.2.4 These applications were approved on 30th May 2007.

5.2.5 Therefore, a wide range of assessments have already been undertaken for these various consent applications. These have been presented in three comprehensive Environmental Statements which are referred to as:

- HEO Environmental Statement;
- OPA Environmental Statement; and
- TWAO Environmental Statement.

5.2.6 In addition, an Overarching Environmental Statement has also been prepared which presents the potential cumulative impacts of the three individual proposals.

Details of Planning Approvals for the London Gateway Development

5.2.7 Original applications for the OPA for the LG Business and Logistics Park, the HEO for the Port and the TWAO for the proposed rail improvements were submitted in January 2002, July 2002 and February 2002 respectively.

5.2.8 Subsequently, following an appeal against non-determination of the OPA, a public inquiry was held by the Secretary of State between February and September 2003. The appeal also considered the HEO and the TWAO.

5.2.9 Following the publication of the Appeal Inspector's Report, the Secretary of State returned two sets of "Minded to Grant" letters requesting further evidence to be submitted. The first "Minded to Grant" letter was issued on 20 July 2005 and the second was issued on 8 August 2006.

5.2.10 After the submission and consideration of the additional evidence, as directed in the "Minded to Grant" letters, the following applications were approved on 30 May 2007:

- A HEO Order for the Port, with rail facilities, including a Roll-on Roll-off (RoRo) and general cargo facilities. The final HEO was made in May 2008.
- An OPA for the LG Business and Logistics Park.
- A TWAO for the non-port railways which could be used to service the LG Development. The final TWAO was made September 2007.

5.2.11 The LG Business and Logistics Park will provide efficient access to London and the South East as well as the rest of the UK. The Port will have a total quay length of approximately 3 km.

5.2.12 GEC will be located on land within the south east corner of the LG Development, and as such much of the following discussion is taken from the OPA Environmental Statement for the LG Business and Logistics Park.

5.2.13 The LG Business and Logistics Park site covers approximately 224 ha. In addition, to the west there is an area of undeveloped land known as the REL and Tongue land which covers approximately 72 ha and an area of farmland which covers approximately 128 ha.

5.3 The GEC and London Gateway Development Site Surroundings

5.3.1 Land immediately surrounding the north / west of the former Shell Oil Refinery site (but within the northern border of the LG Development) largely consists of grazing marshland interspersed by a network of reed-fringed drainage ditches and creeks.

5.3.2 The Manorway (A1014) runs along the northern edge of the overall LG Development for much of its length.

5.3.3 West of the former Shell Oil Refinery site (but within the western border of the LG Development) is cultivated arable land with rises gently towards the north. This land is characterised by generally rectangular arable fields enclosed by hedgerows and trees.

5.3.4 A number of farms are situated in this western area, which include three Grade II Listed Buildings: Old Hall; Old Garlands; and, Great Garlands Farm. Further west, the cultivated arable land abuts a sports ground on the edge of Stanford-le-Hope. This area forms the boundary of Stanford-le-Hope, and adjoins existing housing characterised by a mixture of post-war local authority and 1960s / 1970s sub-urban style housing developments.

5.3.5 East of the former Shell Oil Refinery site is the Aviation Fuel Storage Farm, the existing CECL Power Station and the Coryton Oil Refinery. These are discussed further below.

5.3.6 Most of the southern boundary of the LG Development is adjacent the River Thames. Land to the south west consists of marshes and mudflats.

5.4 Historic GEC and London Gateway Development Site Uses

5.4.1 The area to be developed as part of the London Gateway Business and Logistics Park comprises the majority of the former Shell Oil Refinery together the area of undeveloped land known as the REL and Tongue land.

5.4.2 The Shell Oil Refinery was built at Shell Haven. Historically, Shell Haven was a port on the north bank of the Thames Estuary at the eastern end of Thurrock and formed part of the Port of London.

5.4.3 Shell Haven (sometimes referred to as Shellhaven) was originally an inlet on the north bank of the River Thames approximately 1 mile to the west of Canvey Island. The inlet formed the mouth of Shell Haven Creek which runs to the east and south of the village of Fobbing separating Corringham Marsh from Fobbing Marsh.

5.4.4 Shell Oil first arrived in Shell Haven in the form of the Asiatic Petroleum Company Limited, a subsidiary of Royal Dutch Shell (or more simply Shell), a sales company formed by the merger of Royal Dutch Petroleum and the Shell Transport and Trading Company.

5.4.5 A license was obtained in 1912 to store petroleum at Shell Haven, and refinery operations began on a 40 ha site in 1916 with an associated distillation plant which produced fuel oil for the Admiralty. In 1919 the distillation plant was converted to manufacture bitumen for road surfacing. In 1925, a new plant was erected for the manufacture of lubricating oils and the first high viscosity oils were produced in 1937.

5.4.6 Subsequent development in 1946 saw the commission of plant producing high grade paraffin for candles. In 1947, expansion began on a 400 ha site to the west of the original refinery which saw the construction of a distillation unit designed for Middle East crude oil. This began operations in 1950 with crude oil being pumped into tanks before being distilled to produce butane, methane, petrol, kerosene, gas oil and bitumen. Subsequent to this various units were added to produce valuable hydrocarbons from the distillation residue, including a new bitumen plant which began production in 1981.

5.4.7 In 1992, a major capital investment was completed, adding a ‘Naptha Minus’ complex which contained an isomerisation unit, benzene recovery and gas turbine power generation. A new control centre was added. By this time the plant had a capacity of 4.6 million tonnes per annum and the site covered 800 ha with a 27 km perimeter. It had five jetties which could handle tanks up to 300 000 tons capacity.

5.4.8 The Shell Oil Refinery ceased main operations on the site at the end of 1999, and the site is currently a ’Brownfield’ site with the majority of the structures being cleared. However, the GEC site, and indeed the wider London Gateway Business and Logistics Park site, reflects the former site uses and is generally laid out in a grid formation consisting of access roads, pipelines, remaining plant, hard standing and open car parks.

5.4.9 There are two production facilities remaining on the Shell Oil Refinery site, and these are to be retained by Shell. These are the bitumen plant (approximately 6 ha lying in the middle of the LG Business and Logistics Park to the west of the GEC site) and an Aviation Fuel Storage Farm (lying to the east of the LG Business and Logistics Park and the GEC site).

5.4.10 To the east of the GEC site, the LG Development and the Shell retained Aviation Fuel Storage Farm is the Coryton Oil Refinery owned by Petroplus.

5.4.11 Development on the Coryton Oil Refinery site began in 1895 when Kynochs (an ammunitions firm) purchased Borley Farm to the east of Shell Haven Creek in order to build an explosives factory. This opened in 1897 within a small estate called Kynochtown. In addition, Kynochs also built the Corringham Light Railway (CLR). This included a passenger branch from the explosives factory to Corringham and a goods branch from the explosives factory to the London Tilbury and Southend Railway (LT&SR). The Kynochs works was closed in 1919.

5.4.12 The site and the CLR were taken over by Cory Brothers Limited of Cardiff (coal merchants) who built an oil storage depot, renaming Kynochtown and Coryton. This oil storage depot became Coryton Refinery. In 1950 Coryton and the CLR were sold to the American Vacuum Oil Company, later to become Mobil. The passenger branch of the CLR was closed, but the goods branch to the LT&SR remained open and was upgraded to main line standards.

5.4.13 A new refinery came on stream in 1953, and in the 1970s Coryton village was demolished and absorbed into the refinery site. Coryton was operated by BP from 1996 when Mobil's fuel operations were placed into a joint venture with BP. Following the 1999 merger of Mobil with Exxon, the remaining interest in the refinery was sold to BP in 2000.

5.4.14 In 2007 Coryton Oil Refinery was sold by BP to Petroplus and remains in production today, lying between Shell Haven Creek (to the west) and Hole Haven Creek (to the east). This lies approximately 950 m east of the GEC site.

5.4.15 The existing CECL Power Station is also situated to the east of Shell Haven Creek, approximately 700 m east of the GEC site.

5.5 Designated Sites in the Area

5.5.1 There are no Statutory or Non-Statutory Landscape or Nature Conservation Designations on the GEC site.

5.5.2 However, there are a number of designated ecological sites in the vicinity of the GEC site. Designated ecological designations within 5 km of the site include:

- The Thames Estuary and Marshes Ramsar site;
- The Thames Estuary and Marshes Special Protection Area (SPA)
- Pitsea Marsh Sites of Special Scientific Interest (SSSI);
- Mucking Flats and Marshes SSSI;
- Vange and Fobbing Marshes SSSI;
- Holehaven Creek SSSI;
- Canvey Wick SSSI; and,
- South Thames Estuary and Marshes SSSI.

5.5.3 Within a wider 20 km area, there is an additional:

- 28 Local Nature Reserves;

- 3 National Nature Reserves;
- 4 Ramsar sites;
- 4 SPAs;
- 3 Special Areas of Conservation (SAC); and,
- 38 SSSI.

5.5.4 Designated sites are discussed further in Section 12.

5.5.5 Additionally, and as part of the proposals for the LG Port development, three amelioration lands have been / are being developed. These include:

- Site A – Located at Mucking Flats to the south west of the proposed London Gateway;
- Site X – Located on the south side of the River Thames Estuary, at Salt Feet and Halstow Marshes, to the north of the village of Cliffe; and
- The Northern Triangle – An area of land to the north of The Manorway and to the west of Oozedam Farm, immediately to the north of the former Shell Haven Oil Refinery site.

5.5.6 Sites A and X are areas of land considered for intertidal habitat creation principally on intertidal mudflats. The Northern Triangle is an area of land to be used for the relocation of protected species affected by the Port development, principally water voles, reptiles and invertebrates.

5.5.7 In addition, a further four off site locations are being used for the relocation of water voles and reptiles. These include:

- The River Colne – An inland site located in Essex to be used as a reintroduction site for water voles; and
- Bonner's Farm (Peldon, Essex), Blakehill (Wilshire) and Sandpool (Wiltshire) – To be used for the translocation of reptiles in accordance with an agreed method statement.

5.5.8 Therefore, as part of the works for the surrounding LG Development, DP World will have cleared the GEC site of various species that had previously inhabited the site.

5.5.9 Further details on Ecology are provided in Section 12.

5.6 Other Developments with Potential Cumulative and Indirect Impacts

5.6.1 In addition to considering the potential impacts associated with GEC, the EIA has considered the potential for cumulative impacts with additional elements of the GEC and other developments in the area.

5.6.2 Additional elements of GEC and other developments in the area in the vicinity of GEC which have been identified as potentially generating cumulative impacts are:

- CECL Power Station;
- Coryton Oil Refinery; and
- The LG Development.

5.6.3 However, it should be noted all developments, apart from the LG Development, are already included in the existing baseline environment.

5.6.4 In addition indirect impacts of the proposed GEC have also been considered where appropriate in the assessment. These include:

- The Gas Pipeline associated with GEC;

- The Electricity Transmission associated with GEC; and
- Any CHP Infrastructure.

SECTION 6

ALTERNATIVES

6 ALTERNATIVES

6.1 Introduction

6.1.1 The Electricity Works EIA Regulations require that the ES should include an outline of the main alternatives that have been studied by the applicant and an indication of the main reasons for its choices, taking into account environmental impacts.

6.1.2 In the case of GEC, the alternatives that have been considered are:

- Alternative development sites;
- Alternative technologies for electricity generation
- Alternative technologies for cooling;
- Alternative layouts; and,
- Alternative infrastructure connections.

6.1.3 These alternatives are described below.

6.1.4 Alternative layouts and infrastructure connections are not addressed in detail, as the ultimate layout of the project and its connections can only be determined once a contractor has been appointed for the final design and construction of GEC.

6.1.5 However discussion is included regarding the layout and connections which have formed the basis of this ES and are considered to represent the most likely options for GEC.

6.2 Alternative Development Sites

Evaluation Criteria

6.2.1 There is a range of site-specific environmental issues which affect the suitability of a development site for a power station. These issues fall broadly into two categories:

- Factors which affect the potential magnitude of likely significant environmental impacts; and
- Presence of receptors sensitive to impacts.

6.2.2 Bearing in mind the above environmental issues, InterGen has considered a variety of alternative sites for the purposes of power station development across the UK.

6.2.3 The key factors influencing the decision making process included:

- The close proximity of the national electricity transmission system with capacity to export;
- Attractiveness of the electricity transmission zone;
- The close proximity of the national gas transmissions system;
- Availability of industrial sites with sufficient land area;
- Economic benefits of proximity to the national electricity and gas networks;
- Compatibility with planning polices and local development plan;
- Potential for CHP in the area;
- Environmental considerations (such as conservation designations and the presence of protected species);
- Likely suitability for CCS; and
- Opportunities to link beneficially with local industry such as the direct supply of power to minimise transmission losses.

6.2.4 In addition, the location of existing InterGen power generation is an important consideration in the site selection process (Coryton Power Station). Constructing a new plant near to an existing power station is standard industry practice as it allows power generators to take advantage of economies of scale and utilise existing infrastructure wherever possible.

Development Sites Considered

6.2.5 The site selection studies focused on the south-east as the geographical area for a more detailed search due to the reasons detailed in Section 2. In brief, these include the deficit of generation plants in the area taking into account expected closures of existing plant coupled with a high and rising demand for more electricity in London and the south east.

6.2.6 A number of prospective sites in the south east were considered and through an iterative review process this lead to the identification of three potential sites located near to the existing CECL Power Station.

6.2.7 These included:

- Site A – Part of the LG Development;
- Site B – A 45 acre brown field site located near Canvey Island. However, this site crosses a SSSI; and
- Site C – Not disclosed due to land owner confidentiality requirements.

6.2.8 The three sites were then assessed for suitability based on the environmental issues outlined in Table 6.1.

TABLE 6.1: ENVIRONMENTAL ISSUES CONSIDERED WHEN ASSESSING POTENTIAL DEVELOMENT SITES

Environmental Issue	***Proposed Indicators***
Land Use, Planning Context and Material Assets	Land use/planning designation, mature trees, agricultural resources, mineral resources Land uses of the surrounding area
Air Quality	Background air quality Factors influencing atmospheric dispersion Odour and dust
Noise and Vibration	Existing noise climate Screening and noise attenuation
Landscape and Visual	Visibility of site Existing landscape character of site Existing landscape character of surrounding area Landscape and visual impact
Ecology	Ecological habitats on-site Ecological habitats of surrounding area
Geology, Hydrogeology and Land Contamination	Geology and ground conditions Groundwater resources Surface water resources
Traffic and Infrastructure	Site access Main road network
Cultural Heritage	Archaeology on-site Archaeology and heritage of surrounding area

6.2.9 The key environmental advantages and sensitivities associated with each of the potential development sites identified are summarised in Table 6.2.

TABLE 6.2: KEY ENVIRONMENTAL ADVANTAGES AND SENSITIVITIES

Site	*Key Advantage*	*Environmental Sensitivity*
Site A	Brownfield Closest location for grid and gas connections Significant separation from residential receptors Existing access to service the site. Designated for industrial development, on site of the LG Development	Visual impact Site is within Flood Zone 3a but is protected by primary flood defences which are due to be renewed.
Site B	Brownfield Significant separation from residential receptors	Site is within Flood Zone 3a and not offered as much protection as site A. Crosses a Site of Special Scientific Interest Located in closest proximity to residential receptors
Site C	Second closest location for grid and gas connections Significant separation from residential receptors Existing access to service the site.	Access issues from road network; Ground conditions and contamination; and Proximity to water course

Preferred Development Site

6.2.10 Following the consideration of the three development sites, Site A was chosen as the preferred development site.

6.2.11 There are many advantages to Site A that make it an ideal location for power generation. These include, amongst others:

- The close proximity of the 400 kV National Grid transmission system;
- An electrical connection date of around 2014;
- The close proximity of the National Grid Gas National Transmission System;
- Availability of sufficient ‘Brownfield’ land, including that to be used for the development of a CCGT Power Station and that to be reserved for the retrofitting of a carbon capture plant in the future;
- Transport infrastructure which will accommodate construction traffic;
- The close proximity of the LG Development to allow the GEC to meet it’s expected long-term power requirements of up to 150 MWe;
- The close proximity of the LG Development which has the potential to off-take heat from the GEC;
- Appropriate visual context due to the industrial nature of the immediate area including the existing CECL Power Station, Shell tank farm and the Coryton Oil Refinery, and the LG Development;

- The close proximity of GEC to areas of highest national power demand;
- Availability of technical support (if required) from the existing CECL Power Station;
- Compatibility with Planning Policies and Local Development Plans; and
- Opportunities to link beneficially with local industry.

6.2.12 It is therefore considered that the proposed site (Site A) is suitable for the intended use of power generation.

6.3 Alternative Power Generation Technologies

Evaluation Criteria

6.3.1 InterGen has considered alternative power generation technologies at a strategic level in determining what form of power generation activity to pursue.

6.3.2 The key factors influencing the decision making process were:

- Likely significant environmental effects, including (for example) air emissions, land take transportation and waste;
- The regulatory climate, including consideration of whether the chosen plant will be able to continue to generate for its operational lifetime and whether it is likely to obtain the relevant consents and permits;
- Technical feasibility;
- Economic feasibility; and
- InterGen experience and expertise.

Alternative Power Generation Technologies Considered

6.3.3 There are a number of options available for the generation of up to 900 MWe in the UK. These include:

- Sustainable energy, such as biomass or waste to energy;
- Renewable energy, such as wind or photovoltaics;
- Nuclear power; or
- Fossil fuelled power plant.

<u>Sustainable Energy</u>

6.3.4 There are a small number of biomass plants in the UK which utilise wood, straw or chicken litter as fuels.

6.3.5 Until recently the largest of these was the Thetford 38.5 MWe Chicken Litter Burning Plant in Norfolk, which burns in the order of 200 000 tonnes per annum. However, more recently a new 40 MWe biomass plant near Lockerbie in Scotland was commissioned in December 2007, a 60 MWe biomass plant at Tilbury was consented in August 2009, and a larger 300 MWe biomass plants was consented in July 2009 at Teesside (North East). Additionally several larger 300 MWe biomass plants are proposed in the UK but yet to be constructed.

6.3.6 Due to constraints with regards to space availability and footprint per MWe installed, it is not currently considered feasible to install such a plant at the GEC site.

6.3.7 The largest waste to energy plant in the UK is the 30 MWe Edmonton Waste to Energy facility in North London, with existing proposals to double its capacity. The facility at Edmonton currently incinerates 75 tonnes/hour or 1800 tonnes/day of municipal waste. This is equivalent to that resulting from a population of approximately 260 000.

6.3.8 Therefore, in order to provide in the order of 900 MWe, the plant would need to incinerate the waste from a population of over 7.8 million. This is clearly impracticable in terms of the collection and transport of such quantities of waste. In addition, due to their significant expense waste to energy plants are generally regarded as a waste management option rather than primarily a power generation option.

Renewable Energy

6.3.9 In order to provide up to 900 MWe from wind turbines, approximately 1000 tall turbines would be required to provide the same nominal annual power output[6].

6.3.10 This estimate incorporates the UK's average capacity factor for wind turbines of 30 per cent (British Wind Energy Association standard emissions saving methodology), which means that over a year a turbine could produce 30 per cent of the amount of electricity it could theoretically produce if it was working continuously at full capacity all through the year.

6.3.11 Therefore, to produce the equivalent 900 MWe that GEC could produce, around 3000 MWe of wind power would be required to be installed. This would require up to 300 hectares of land. Although, 99 per cent of this land could still be used for productive farming, the tall wind turbines (each of the order of 120 m in height) would have a significant visual impact over such a vast area.

6.3.12 In addition, complications arise when wind turbines are located in remote locations where the wind resource is abundant, as this introduces subsequent transmission issues.

6.3.13 For these reasons wind turbines are not considered a practicable option to provide a similar power output as GEC.

6.3.14 Solar photovoltaic panels convert light energy directly into direct current (DC) suitable for charging a battery. Due to their small scale they are not considered feasible for providing up to 900 MWe in the UK.

Nuclear Power

6.3.15 Using nuclear power as an alternative generation technology would require that the site was considered by the UK Government as a potential site for a new nuclear plant.

6.3.16 The full list of potential sites considered appropriate by the UK Government for development of new nuclear power stations was released in April 2009. These potential sites consisted: Dungeness, Kent; Sizewell, Suffolk; Hartlepool, Cleveland; Heysham, Lincolnshire; Sellafield, Cumbria; Braystones, Cumbria; Kirksanton, Cumbria; Wylfa Peninsula, Anglesey; Oldbury, West Midlands; Hinkley Point, Somerset; and, Bradwell, Essex.

6.3.17 As the GEC has not been identified on the list of potential locations for new nuclear power stations, nuclear power as a generation technology was not considered a viable option.

Fossil Fuelled Power Plant

6.3.18 A 900 MWe coal fired power plant could be constructed to generate the electricity. The coal fired power plant could be either:

- Conventional pulverised fuel fired with appropriate pollution control techniques. These would include flue gas desulphurisation (FGD) and selective catalytic reduction (SCR), which would control sulphur dioxide (SO_2) and oxides of nitrogen (NO_x) respectively to meet LCPD limits and Environment Agency benchmarks;
- Fluidised bed technology with in bed capture of SO_2 and appropriate techniques for NO_x control, such as SCR; or

[6] *Based on 3 MWe wind turbines.*

- Coal gasification coupled with a CCGT plant.

6.3.19 The coal fired plant could operate at sub-critical steam conditions similar to all existing coal fired plants in the UK or could operate more efficiently using super-critical steam conditions. Such super-critical conditions are likely to be applied on all new coal fired plant in the UK.

6.3.20 However, given the higher specific emissions per kWh of power generated and the greater land-take required, a coal fired plant is not considered to be preferable compared to a CCGT plant.

6.3.21 Coal gasification is considered to have considerably high commercial risk associated with its development, as it is relatively new technology and as yet, unproven in the long-term.

6.3.22 Development of a 900 MWe oil fired plant could take the form of either a conventional boiler / steam turbine power plant with appropriate control of SO_2 and NO_x to meet LCPD limits and EA Guidelines, or oil gasification coupled with a CCGT plant.

6.3.23 However, given the proportionally high cost of oil, it is considered uneconomic to develop such a large oil fired power station.

Preferred Power Generation Technology

6.3.24 Table 6.3 shows a comparison of the atmospheric emissions from the power plants described above in comparison to a gas fired CCGT power plant similar to that proposed for GEC. All atmospheric emissions are scaled to those resulting from the generation of 900 MWe.

6.3.25 Table 6.3 shows that GEC would result in significantly lower emissions on a g/MWh basis for almost air pollutants considered, including carbon dioxide (CO_2). The exceptions are for NO_x and CO, although it should be noted that the level of NO_x reported is only higher than that reported for coal gasification with CCGT power plant, and is lower than the other three types of plant.

TABLE 6.3: COMPARISON OF ATMOSPHERIC EMISSIONS OF NEW POWER PLANTS

Parameter	***Units***	***Proposed CCGT***	***Conventional Oil Fired Power Plant with FGD and SCR***	***Conventional Coal Fired Power Plant with FGD and SCR***	***Supercritical Coal Fired Power Plant with SCR***	***Coal Gasification with CCGT Power Plant***
NO_x	Emission Limit (mg/Nm^3)	50	200	200	200	50
	g/MWh	311	538	708	580	213
SO_2	Emission Limit (mg/Nm^3)	Negligible	200	200	200	1
	g/MWh	Negligible	538	708	585	4
Particulates	Emission Limit (mg/Nm^3)	Negligible	30	30	30	1
	g/MWh	Negligible	81	106	88	4
CO	Emission Limit (mg/Nm^3)	100	100	100	100	100
	g/MWh	622	269	354	292	416
O_2 content of Flue Gases	%	15	3	6	6	15
CO_2	kg/MWh	389	717	913	754	719

6.3.26 Based on the information provided in Table 6.3, the following NO_x and CO_2 emissions savings can be estimated for GEC compared to other forms of fossil fuel generation.

Emissions Saving Calculations

6.3.27 The following assumptions are used in the calculations:

Power plant electrical generation capacity – 900 MWe

Power plant average annual availability – 93 per cent

6.3.28 It can be noted that further emissions savings could be made based on additional factors including thermal efficiency, but these are discounted here and the numbers are provided for comparative purposes only.

6.3.29 The calculation of MWh per year is based on:

Number of MWe × Number of Hours per Year × Annual Availability

Therefore:

$900 \times 8760 \times 0.93 = 7\,332\,120$ MWh

6.3.30 The calculation of g emissions per year is then based on:

Number of MWh operation per year × Emissions per MWh (based on Table 6.2)

6.3.31 The NO_x savings are calculated below:

Proposed CCGT

$7\,332\,120 \times 311 = 2\,280\,000\,000$ g NO_x = 2 280 tonnes NO_x

Conventional Coal Fired Power Plant with FGD and SCR

$7\,332\,120 \times 708 = 5\,190\,000\,000$ g NO_x = 5 190 tonnes NO_x

Supercritical Coal Fired Power Plant with SCR

$7\,332\,120 \times 580 = 4\,250\,000\,000$ g NO_x = 4 250 tonnes NO_x

6.3.32 The CO_2 savings are calculated below:

Proposed CCGT

$7\,332\,120 \times 389 = 2\,850\,000\,000$ kg CO_2 = 2.85 million tonnes CO_2

Conventional Coal Fired Power Plant with FGD and SCR

$7\,332\,120 \times 913 = 6\,690\,000\,000$ kg CO_2 = 6.69 million tonnes CO_2

Supercritical Coal Fired Power Plant with SCR

$7\,332\,120 \times 754 = 5\,530\,000\,000$ kg CO_2 = 5.53 million tonnes CO_2

6.3.33 It should be noted that the above are calculated at the ELV with the GEC plant likely to out perform this level to a significant degree.

Summary

6.3.34 Based on the calculations above GEC would emit approximately 2 280 tonnes of NO_x. In comparison, a new supercritical coal fired power plant would emit approximately 4 250 tonnes of NO_x and an existing conventional coal fired power plant would emit approximately 5 190 tonnes of NO_x when generating an equivalent electrical capacity.

6.3.35 Therefore, this would equate to a total saving of the order of 2 910 tonnes of NO_x if GEC were to displace an equivalent existing conventional coal fired power station and 1 970 tonnes of NO_x were is to displace an equivalent supercritical coal fired power station.

6.3.36 Additionally, based on the calculations above GEC would emit approximately 2.85 million tonnes of CO_2. In comparison, a new supercritical coal fired power plant would emit approximately 5.53 million tonnes of CO_2 and an existing conventional coal fired power plant would emit approximately 6.69 million tonnes of CO_2 when generating an equivalent electrical capacity.

6.3.37 Therefore, this would equate to a total saving of the order of 3.84 million tonnes of CO_2 if GEC were to displace an equivalent existing conventional coal fired power station and 2.68 million tonnes of CO_2 were is to displace an equivalent supercritical coal fired power station.

6.3.38 As such, the operation of GEC could make a significant contribution to the UK Government's Policy of reducing CO_2 emission levels whilst maintaining a secure supply of electricity.

6.3.39 Additionally, GEC will, due to its greater efficiency, help the UK to conserve its national allocation of CO_2 allowances due to its much lower CO_2 emissions compared to those from similar sized coal and oil fired power plant. This will have a beneficial effect on the economy of the UK, which is expected to be further impacted upon by the price of carbon allocations in the future.

6.3.40 Table 6.4 provides a comparison of other impacts of the fossil fuel generation sources for plants rated at 1000 MWe.

TABLE 6.4: A COMPARISON OF THE IMPACTS OF NEW 1000 MWE FOSSIL FUEL GENERATING PLANT

Parameter	***Units***	***Proposed CCGT***	***Conventional Oil Fired Power Plant with FGD and SCR***	***Conventional Coal Fired Power Plant with FGD and SCR***	***Supercritical Coal Fired Power Plant with SCR***	***Coal Gasification with CCGT Power Plant***
Efficiency	%	55	38	38	46	48
Footprint	m^2	7,000	12,000	15,000	15,000	15,000
Solid Waste						
Ash*	kt/a	Nil	Nil	340	281	269
Gypsum*	kt/a	Nil	90	137	113	Nil
Miscellaneous	t/a	140	1800	1800	1800	1800
Stack Height**	m	55+	190	190	190	55+
Water Treatment Plant Effluent ‡	m^3/h	6	23	23	113*	21
FGD Effluent	m^3/h	Nil	32	32	32	Nil
Boiler Blowdown	m^3/h	35	90	90	Nil	105
Total Effluent	m^3/h	41	145	145	145	126
Cost	£/kW Installed Capacity	600	950	1050	1080	1500

* *Gypsum and ash can be sold as useful by-product if of sufficient quality and a market is available, otherwise these must be disposed of to landfill.*
** *Stack height dependant on location of plant and its surroundings*
‡ *Including effluent from condensate polishing for supercritical plant.*

6.3.41 Additionally, and as shown in Table 6.4, CCGT plants have a much smaller footprint and capital cost than other types of conventional thermal power plant.

6.3.42 A gas-fired CCGT plant will, therefore, offer BAT for GEC.

6.4 Alternative Cooling Technologies

Evaluation Criteria

6.4.1 InterGen has considered alternative cooling technologies at a strategic level in determining what form of power generation activity to pursue.

6.4.2 The main decisions influencing the decision making process were:

- The form of the cooling technology at the existing CECL Power Station;
- The availability of land;
- The reduction in environmental impacts, including:
  - Reduction in noise;
  - Reduction in emissions;
  - Reduction in visual impacts; and
  - Reduction in water use and protection of the water environment.
- Financial considerations

Alternative Cooling Technologies Considered

6.4.3 CCGT plants utilise the heat from the exhaust gases leaving the gas turbine to generate steam in a HRSG. This steam is then used in steam turbine equipment to generate further electricity. The steam leaving the steam turbine equipment is condensed by either water or air, producing condensate that is then reused in the HRSG.

6.4.4 Available, potential cooling techniques for the condensing of steam leaving the steam turbine equipment include:

- Once through cooling (direct river or sea water cooling);
- Evaporative cooling towers;
- Hybrid cooling towers; and
- Air cooled condensers (ACC).

<u>Once through Cooling</u>

6.4.5 As the GEC site is close to the River Thames, there is a potential for a once-through cooling system using the water from the river.

6.4.6 However, if this option were to be employed, further ecological stress will be placed on the River Thames and due to the potential environmental impacts, this cooling system is currently not considered viable.

<u>Evaporative Cooling Towers / Hybrid Cooling Towers</u>

6.4.7 Another potential cooling system would be to employ cooling towers, which could be either evaporative cooling towers or hybrid cooling towers.

6.4.8 However, these would also require a significant quantity of water to be used as make-up to replace the water lost by evaporation. There are two potential sources for make-up water which are the River Thames or the domestic water supply.

6.4.9 As with a once-through cooling system, further ecological stress will be placed on the River Thames, whilst the use of a domestic water supply in cooling towers is not considered a viable use of a supply that is already under pressure.

<u>Preferred Cooling Technology</u>

6.4.10 Therefore, due to the lack of a suitable viable cooling water source at the GEC site, only ACCs would be able to provide a practical cooling system.

6.4.11 The performance of ACCs (as for cooling towers), is dependent on ambient temperature and is also sensitive to prevailing wind direction, gusty conditions and the height and position of buildings and other structures in the vicinity.

6.4.12 GEC will be designed to minimise the impact of these sensitivities and ensure optimum operational performance. The preferred design for ACC units position the heat exchangers above the fan units, at approximately 35 m above the ground surface.

6.5 Alternative Layouts

Evaluation Criteria

6.5.1 GECL has considered a number of alternative layouts for GEC.

6.5.2 The main decisions influencing the decision making process were:

- The layout of the existing CECL Power Station;
- The availability of land;
- Road access and access arrangements with the London Gateway development;
- Connection to the national electricity transmission system;
- Connection to the national gas transmissions system;
- Reduction in environmental impacts including:
    - Reduction in noise;
    - Reduction in emissions;
    - Reduction in visual impacts; and
    - Reduction in water use and protection of the water environment.
- Provisions to minimise environmental impacts;
- Compliance with Regulatory Requirements;
- Compliance with Government Guidance;
- Compliance with the requirements of the London Gateway developer;
- Plant and personnel safety;
- Provision for future development of additional emission abatement equipment, such as carbon capture and storage equipment;
- Technical requirements; and
- Financial considerations.

Summary Discussion of Alternative Layouts

6.5.3 It is anticipated that the contractor who will design and construct the proposed plant will be appointed after the consent is granted. Therefore, it is not until this stage that the detailed design of the layout for GEC will be optimised. For this reason, it is not possible at this stage to provide definitive layout plans for GEC.

6.5.4 The layouts which has been assumed for the purposes of this ES and the associated studies has been developed through preliminary engineering studies. At present, these are considered to be the most likely layouts for GEC.

6.5.5 Currently, two main layout options are considered in relation to GEC. These are the single-shaft and the multi-shaft unit layouts. The principal difference between these two layouts is that the multi-shaft uses one large steam turbine, whereas the single-shaft option uses two smaller steam turbines. Both options would generate the same amount of power.

6.5.6 The proposed layouts are shown in Figure 4.1 and Figure 4.2.

6.5.7 Again, it is emphasised that these layouts are preliminary and are subject to change as the detailed design phases of the project progress. Any such changes would be agreed in writing with TTGDC pursuant to the Section 36 consent.

6.5.8 In terms of a comparison, both the single-shaft and multi-shaft options would see the gas turbines aligned west to east across the GEC site, with the ACC along the eastern border of the site. The difference lies in where the steam turbine equipment is situated.

6.5.9 For the purposes of this ES, modelling has been undertaken using the multi-shaft layout, as it is likely that this layout would represent a marginally 'worst-case' scenario in terms of emissions to air, water and land.

6.5.10 The likely maximum dimensions of GEC are discussed in Section 4 and are detailed in Table 4.1.

6.5.11 The ultimate design will be the subject of a planning condition that will require GECL to agree the final design and appearance of GEC with TTGDC prior to construction commencing.

6.6 Alternative Infrastructure Connections

6.6.1 As discussed in Section 4 there are a number of interconnections that will be required to allow for the construction and operation of the GEC. These include:

- A new underground gas line to connect to the National Gas Grid;
- A new underground cable, new over ground transmission line or combination of both to connect to the National Grid electricity network; and
- A potential connection for future CHP to the London Gateway and other customers in the local area.

6.6.2 GECL have undertaken an initial study of these various interconnections. The outcome of these studies is detailed below.

Gas Connection

6.6.3 The gas connection study identified the need for a new connection to the National Gas Grid independent of that which already serves the existing CECL Power Station. To this end GECL have undertaken a feasibility study to identify possible route options for a new underground gas pipeline. The feasibility study also considered options for the location of the Above Ground Installations (AGIs) to allow for interconnection to the National Transmission System (NTaS). This will likely be located close to St Clere's Golf Course near to the existing AGI for the CECL Power Station gas pipeline.

6.6.4 A number of options have been reviewed for the proposed GEC gas pipeline route and associated off-take as part of this feasibility study.

6.6.5 After due consideration of the technical, commercial and environmental factors, the feasibility study highlighted two preferred options. These are shown on Figure 6.1.

6.6.6 The proposed gas pipeline will be the subject of a separate consent application in due course, and a further EIA will be included as part of the application. Further details of the various route alternatives will be detailed in that consent application as appropriate.

HV Electricity Connection

6.6.7 Similar to the gas pipeline, a feasibility study for the electrical connection to the HV National Grid system has been undertaken. The potential route options are shown Figure 6.2.

6.6.8 National Grid has proposed that the connection to the system would be via a new substation they propose to construct most likely at Mucking Flats. The feasibility study found that the most likely connection would be via an underground cable (due to spatial constraints) to a point north of the A1014 (The Manorway) Road and then via an over ground connection to the proposed NG substation most likely at Mucking Flats. This option has been identified as likely having the least environmental impact. It is however important to note that this route is the subject of on going studies. The proposed electrical connection will be the subject of a separate consent application in due course and a further EIA will be included as part of the application. Further details of the various route alternatives will be detailed that consent application as appropriate.

CHP Interconnections

6.6.9 There is currently insufficient information regarding any off takers for heat to allow for any details of CHP interconnections to be discussed in this ES. However space has been allowed for in the layout of the GEC to accommodate CHP as required. This is discussed in the CHP Assessment that accompanies the Section 36 Consent application for GEC.

SECTION 7

EIA METHODOLOGY AND ES CONTENT

7 EIA METHODOLOGY AND ES CONTENT

7.1 Overview

7.1.1 This ES has been prepared to document the findings of the EIA which has been undertaken to determine the potential extent of any likely significant environmental effects with regard to the development of GEC covering the following impacts: direct, indirect, secondary or cumulative; short, medium or long term; permanent or temporary; and, positive or negative.

7.1.2 In accordance with the Electricity Works EIA Regulations, the ES goes on to identify measures envisaged to avoid, reduce and, if possible, remedy any significant adverse impacts identified. For impacts that cannot be entirely remedied, the ES identifies the residual adverse effects once the mitigation is considered.

7.1.3 Monitoring has been recommended in some cases to help demonstrate that GEC is able to operate in compliance with the performance criteria identified in this ES.

7.2 Environmental Impact Assessment Project Team

7.2.1 GECL has appointed an EIA Project Team to assist in the development of the consent application and preparation of the ES. The members of the EIA Project Team and their respective roles are presented in Table 7.1.

TABLE 7.1: EIA PROJECT TEAM

Company	***Role***	***Input***
PB	Environmental / Engineering Consultants	ES Chapters and Project Management
Dalton Warner Davis	Planning Consultant	Review of ES ES Chapter on Planning Policy Context
Studio E	Architect	Architectural Design
Herbert Smith	Planning and environmental Solicitors	Review of ES
Pendragon Consulting	Public Relations and Communication	NA

7.2.2 Additionally, to date, a significant proportion of work has been carried out on the surrounding LG Development by DP World and their Consultants. This work has been used in the ES (discussed previously) associated with applications made by DP World for the LG Development.

7.2.3 Details of the reports used for the purposes of this ES are provided in Appendix B, and information from these reports is referenced and incorporated where appropriate.

7.3 Purpose of the Environmental Impact Assessment

7.3.1 The purpose and objective of an EIA is to report objectively on the environmental impacts of a project, in this case the development of GEC, to determine whether the environmental impacts are considered to be within acceptable limits.

7.3.2 Additionally it serves to inform the design to ensure that, wherever possible, environmental impacts are minimised in the design itself.

7.4 Methodology of the Environmental Impact Assessment

7.4.1 In accordance with the Electricity Works EIA Regulations the assessment process for GEC has included the following:

- Discussions with consultees on the key issues on which the EIA should focus;

- Identification of any alternatives to the proposed development;
- Establishing baseline environmental conditions through desk-top research and site-surveys;
- Identifying the impacts of GEC;
- Determining how impacts will be avoided or reduced through design evolution or additional mitigation measures;
- Assessing the significance of cumulative environmental impacts;
- Describing how likely significant future impacts will be monitored; and
- Reporting the process, results and conclusions of the EIA in an ES.

7.4.2 A brief description of these steps is provided here.

Identification of Environmental Baseline

7.4.3 In undertaking an EIA for any project it is important to identify the environmental baseline at the site being considered. This allows the impacts of the proposed project to be seen in the light of the existing environment and allows for better identification of the most appropriate mitigation which could be employed to minimise these impacts.

7.4.4 In identifying the baseline environmental conditions for GEC, two scenarios are presented. These are as follows:

<u>Existing Baseline</u>

A description of the existing baseline environmental conditions on site at present, and as identified in the ES for the LG Development.

<u>Future Baseline</u>

As part of the works for the LG Development, the GEC site will be levelled and provided to GECL in a condition that would allow for construction of GEC. As such, a future baseline has been assumed and is reported in this ES. The future baseline describes the site post-works for the LG Development.

7.4.5 To establish these baselines, a wide range of data on the environment has been used and has been gathered from a combination of sources. This has included:

- Documentary information, including that available from the previous environmental work at the LG Development;
- Field survey information, including: ecological features; landscape character; background noise levels; and traffic levels on the road network; and
- Data from Statutory and Non-Statutory consultees.

7.4.6 In this ES, the identified future baseline environmental conditions are then used to assess the potential impacts of GEC against the potential construction / operation dates. These are as follows:

- Start of Construction: around 2012
- Connection and Commissioning: around 2014
- Full Operation around 2015

Description of the Proposed Project and Identification of Potential Impacts

7.4.7 A full description of GEC is provided in Section 4, with further details on the GEC site and its surroundings provided in Section 5. Further details on specific aspects of GEC, the GEC site and its surroundings are included in respective Sections of this ES as required.

Evaluation and Quantification of Potential Impacts

7.4.8 To help evaluate and quantify the likely significant environmental effects of GEC, environmental significance criteria can be employed to ensure that the identified impacts are within acceptable limits.

7.4.9 The identified impacts may be direct, indirect, secondary or cumulative. Within these categories they may be short, medium or long-term, permanent or temporary, and, positive or negative.

7.4.10 Direct impacts are changes to the baseline arising directly from activities that form part of the development. For example, direct impacts may include localised increases in noise during construction.

7.4.11 Indirect and secondary impacts are those which arise as a result of a primary impact. For example, deterioration of water quality in a watercourse due to an effluent discharge (which would be a direct impact) could have an indirect / secondary impact on aquatic biodiversity.

7.4.12 Cumulative impacts occur when a receptor is subject to multiple impacts.

7.4.13 Environmental significance criteria are important as they inform the determination by the competent authority of the overall acceptability of the proposal.

7.4.14 The environmental significance criteria are determined by considering both the character of change (i.e. the size and duration of the impact) and the value / sensitivity of the receptor/ The environmental significance criteria used in this ES reflect the specific impact under consideration and wherever possible are based on recognised methodologies such as those identified by the Landscape Institute and IEMA.

Monitoring and Mitigation Philosophy

7.4.15 Full consideration is then given to the potential mitigation techniques which could be used to ensure that the adverse significant environmental impacts of the project are minimised.

7.4.16 In the hierarchy of mitigation, likely significant adverse effects should in the first instance be avoided altogether, the reduced and finally offset.

7.4.17 Significant adverse effects are best avoided through the design. As such the iterative nature of the EIA can help to inform the development of the design process.

7.4.18 GEC has and will continue to be developed in such a way that reduction and, wherever possible, elimination of adverse significant environmental impacts associated with the project are an integral component to the overall project design.

7.4.19 Where it is not possible to avoid adverse significant environmental effects, plans have been prepared to help compensate for the impact identified.

7.5 Presentation of the Environmental Impact Assessment

7.5.1 Each of the EIA Sections contained within this ES have been broken down to include a number of sub-sections. These are:

- ***Introduction***
  This sub-section will provide details of the key issues with regard to the specific environmental impacts being considered.
- ***Key Legislation and Planning Policies***
  This sub-section will provide a summary of the National, Regional and Local Planning Policies which are relevant to the topic being assessed.
- ***Assessment Methodology and Significant Criteria***
  This sub-section will provide details of the assessment methodology adopted for the purposes of the EIA. The assessment methodology chosen reflects the relevant guidelines and legislative standards. In addition, significance criteria

to be used to quantify the extent of the environmental impact of the proposed plant will be identified.

- ***Baseline Conditions and Receptors***
  This sub-section will present discussion on the existing and future baselines, and provide discussion on the features of the future baseline which could potentially be impacted on by GEC.

- ***Potential Impacts***
  This sub-section will discuss the findings of the EIA studies, and will take in to consideration the potential construction / operation timeline for GEC as discussed above. Potential environmental impacts are identified as being: direct and indirect; long, medium or short term; and, positive, neutral or negative. In undertaking this assessment both quantitative and qualitative evaluations are necessary, in varying degrees, depending on the nature of the environmental impact being assessed. Significance of the environmental impacts identified is addressed as appropriate with reference to the significance criteria established.

- ***Mitigating Measures and Monitoring Programmes***
  This sub-section will provide details of the mitigation measures that have been identified to ensure that any potential adverse environmental impacts are either minimised or, wherever possible, avoided altogether. In some cases, monitoring is identified to allow it to be demonstrated that the mitigation measures employed are effective.

- **Assessment of Residual Effect**
  This sub-section identifies any residual, post-mitigation, effects likely to be caused by the GEC.

- ***Cumulative and Indirect Impacts***
  This sub-section will identify the likely significant environmental impacts of GEC in conjunction with the various other projects, both existing and proposed in the vicinity. These have previously been discussed in Section 5. It will also discuss the indirect impacts of the proposed GEC, i.e. those associated with the HV electricity connection, gas connection and any CHP connections as appropriate.

7.6 Content of the Environmental Statement

Information required by the Electricity Works EIA Regulations

7.6.1 The required content of the ES is set out in Schedule 4 of the Electricity Works EIA Regulations.

7.6.2 Table 7.2 presents these requirements and indicates where these requirements are met in this ES.

TABLE 7.2: INFORMATION REQUIRED IN AN ES AS SET OUT IN SCHEDULE 4 OF THE ELECTRICITY WORKS EIA REGULATIONS

	Required Information	***Section of this ES***
PART I		
1	Description of the development, including in particular – ▪ A description of the physical characteristics of the whole development and the land-use requirements during the construction and operation phases; ▪ A description of the main characteristics of the production processes, for instance, nature and quantity of the materials used; ▪ An estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc) resulting from the operation of the development.	Section 4 and Section 5 Impact Assessment Sections 9 to 17
2	A description of the aspects of the environment likely to be significantly affected by the development, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the inter-relationship between the above factors.	Impact Assessment Sections 9 to 17
3	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, resulting from: ▪ The existence of the development; ▪ The use of natural resources; ▪ The emissions of pollutants, the creation of nuisances and the elimination of waste, and ▪ The description by the applicant or appellant of the forecasting methods used to assess the effects on the environment.	Impact Assessment Sections 9 to 17
4	A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.	Impact Assessment Sections 9 to 17 Section 18
5	A NTS of the information provided under paragraph 1 to 4 of this Part.	Non-Technical Summary
6	An indication of any difficulties (technical deficiencies of lack of know-how) encountered by the applicant or appellant in compiling the required information.	Impact Assessment Sections 9 to 17
PART II		
1	A description of the development comprising information on the site, design and size of the development.	Section 4 and Section 5
2	A description of the measures envisaged in order to avoid, reduce, and if possible remedy significant adverse impacts.	Impact Assessment Sections 9 to 17 Section 18
3	The data required to identify and assess the main effects which the development is likely to have on the	Impact Assessment Sections 9 to 17

	environment.	
4	An outline of the main alternatives studied by the applicant or appellant and an indication of the main reasons for his choice taking into account the environmental effects.	Section 6
5	A NTS of the information provided under paragraphs 1 to 4 of this Part.	Non-Technical Summary

SECTION 8

STAKEHOLDER CONSULTATIONS AND ADDITIONAL STUDIES

8 STAKEHOLDER CONSULTATIONS AND ADDITIONAL STUDIES

8.1 Overview

8.1.1 In undertaking the EIA and the associated supporting studies, GECL and their consultants have undertaken consultations with a variety of stakeholders. These have included the Secretary of State, the Local Planning Authority, local residents and governmental and non-governmental organisations.

8.1.2 A summary of consultations undertaken to date and planned future consultations that will be made are provided below.

8.2 Discussions with Consultees

8.2.1 GECL sought the opinion of a number of parties such as the DECC, the East of England Regional Assembly (EERA); the Environment Agency (EA), TTGDC, Essex Wildlife Trust (EWT) and Natural England (NE) as to their opinion on the information to be contained within the ES. This has allowed GECL to be clear about the likely significant environmental effects of GEC and therefore the topics on which the ES should focus.

8.3 Community Involvement / Residents Information Days

8.3.1 GECL has also informed the public of proposals regarding GEC via a number of measures. These have included: meetings; exhibitions (Resident's Information Days); newsletters; website and e-mail; free-phone and freepost; advertisements; and, press releases. Full details of these can be seen in the Statement of Community Involvement for GEC.

8.3.2 At the Residents Information Days members of GECL, InterGen and their consultancy teams were available to address the questions and queries of the local community.

8.3.3 The Residents Information Days aimed to:

- Raise awareness of GEC and its likely impacts;
- Receive comments on GEC and the scope of the EIA; and
- Establish the concerns, whether real or perceived, of stakeholders, in order that these can be addressed and, where practical, mitigated.

8.3.4 The Residents Information Days were held on the 9th and 10th of February from 2 pm to 8 pm.

8.3.5 Prior to the Residents Information Days notices were published in the local papers and individual invitations were sent to a number of householders in the vicinity of the site.

8.3.6 Over the two Residents Information Days, 125 people signed the visitor book, however it was noted that a small number of people did not sign in, either walking past a congested entrance or declining to do so.

8.3.7 A Questionnaire / Feedback Form was available at the Resident's Information Days which visitors were encouraged to complete to give their opinion on GEC and ask any questions in writing. A total of 85 questionnaires were completed or partially completed during the exhibitions.

8.3.8 From the 85 questionnaires:

- 53 per cent of people were very positive / positive towards GEC;
- 34 per cent of people were neutral;
- 8 per cent of people were negative / very negative; and
- 5 per cent of people did not provide a response.

8.4 Additional Studies

8.4.1 A number of additional studies were undertaken in support of the consent application for GEC. These included a:

- Carbon Capture Ready (CCR) Feasibility Study; and
- Combined Heat and Power (CHP) Assessment.
- Design and Access Statement; and
- Planning Statement.

8.4.2 These documents have been produced as 'stand-alone' documents. As such, they are not appended to this ES.

8.4.3 Summaries of these technical studies are provided below.

Carbon Capture Ready (CCR) Feasibility Study

8.4.4 The European Union (EU) agreed the text of a new EU Directive on the Geological Storage of Carbon Dioxide on 17 December 2008. This text was published as the Directive on the Geological Storage of Carbon Dioxide (Directive 2009/31/EC) in the Official Journal of the European Union on 5 June 2009 and the Directive came into force on 25 June 2009.

8.4.5 This Directive amends the LCPD so as to provide that Member States are to ensure that operators of all combustion plants with an electrical capacity of 300 MWe or more (and for which the construction / operating license was granted after the date of the Directive) have assessed whether:

- Suitable storage sites for CO_2 are available;
- Transport facilities are technically and economically feasible; and
- It is technically and economically feasible to retrofit for CO_2 capture.

8.4.6 An Assessment of whether these conditions are met is then to be submitted to the relevant competent authority. The competent authority shall then decide if the conditions are met on the basis of the assessment and other available information.

8.4.7 If the conditions are met, the competent authority shall ensure that suitable space is set aside for the equipment necessary to capture and compress CO_2.

8.4.8 In the UK the relevant competent authority in respect of energy matters is the Department of Energy and Climate Change (DECC). DECC must ensure the CCS Directive is implemented. It is also free to impose more stringent regulations on power plants within the UK.

8.4.9 In June 2008, the UK Government published a consultation document "Towards Carbon Capture and Storage" to seek views on the steps it could take to prepare for and support both the development and deployment of carbon capture and storage technologies.

8.4.10 A response to this consultation was published in April 2009, alongside draft Guidance for applicants seeking consent for new combustion power stations at or over 300 MWe[7] (the draft Guidance). The draft Guidance aimed to reflect the Government's new CCR Policy, and was subject to an eight week consultation period which ended on 22 June 2009.

8.4.11 The responses from the consultation period were incorporated into final Guidance applicants seeking consent for new combustion power stations at or over 300 MWe[8] (the Guidance).

---

[7] *Guidance on Carbon Capture Readiness and Applications under Section 36 of the Electricity Act 1989 (DECC, April 2009)*

[8] *Carbon Capture Readiness (CCR) A Guidance Note for Section 36 Electricity Act 1989 Consent Applications (DECC, November 2009)*

Guidance Requirements

8.4.12 Under the new CCR Policy, and as part of a CCR Feasibility Study which will accompany the consent application, the Guidance states that consent applicants will be required to demonstrate:

- "*That sufficient space is available on or near the site to accommodate carbon capture equipment in the future;*
- *The technical feasibility of retrofitting their chosen carbon capture technology;*
- *That a suitable area of deep geological storage off shore exits for the storage of captured CO_2 from the proposed Power Station;*
- *The technical feasibility of transporting the captured CO_2 to the proposed storage area; and*
- *The likelihood that it will be economically feasible within the Power Station's lifetime, to link it to the full CCS chain, covering retrofitting of carbon capture equipment, transport and storage*".

8.4.13 Further to this: "*if Applicant's proposals for operational CCS involves the use of hazardous substances, they may be required to apply for Hazardous Substances Consent (HSC). In such circumstances they should do so at the same time as they apply for Section 36 Consent*".

CCR Feasibility Study Conclusions

8.4.14 In line with this Policy, GECL has undertaken a CCR Feasibility Study to fulfil the requirements detailed above. The CCR Feasibility Study presented the results of the required assessments for the proposed GEC, demonstrating:

- The availability of suitable storage sites;
- The technical feasibility of transport facilities;
- The technical feasibility of retrofit;
- The economic feasibility of transport facilities and retrofit; and,
- Establishes that there is suitable space for CCS equipment at the GEC site.

8.4.15 In respect of the economic feasibility for transport facilities and retrofit, it is considered that these are expected to become economically feasible at some point in the future given:

1. The recent and likely future developments in CCS technology, much of which will stem from the proposed CCS Demonstration Competition to be funded by DECC and the EU;
2. The likely long-term movements in the price of carbon;
3. The proposed treatment in Phase III of the EU ETS of carbon which is emitted, captured and stored; and, in particular,
4. The UK Government's stated commitment to establishing the necessary Economic and Regulatory Framework for CCS.

8.4.16 Therefore, it is considered that these assessments have demonstrated that it could be both technically and economically feasible to retrofit carbon capture and storage technology to GEC within its 35 year operating lifetime.

Combined Heat and Power Assessment

8.4.17 As part of their national energy policy, the UK Government is committed to promoting the installation of CHP wherever economical. As such, they have set a target to achieve at least 10 GWe of installed CHP capacity by 2010. To achieve this target Government Policy has been formulated to support the provision of CHP generation wherever feasible.

8.4.18 Therefore, to promote the use of CHP technology, the Government expects developers to submit information in support of Section 36 consent applications which demonstrates that they have seriously explored opportunities for CHP.

8.4.19 The requirements of this assessment are outlined in the Department of Trade and Industry (DTI) (now DECC) guidance document 'Guidance on Background Information to Accompany Notifications under Section 14 (1) of the Energy Act 1976 and Applications under Section 36 of the Electricity Act 1989, December 2006'. This Guidance will also apply to applicants seeking a Development Consent Order under the Planning Act 2008.

8.4.20 In line with Government policy and the guidance, GECL has undertaken a CHP Assessment to investigate the potential to incorporate a CHP element into GEC. CHP will increase the energy utilisation associated with GEC, and help to reduce the generation of greenhouse gases.

Guidance Requirements

8.4.21 The guidance requires developers to explore opportunities to use CHP, including community heating, when developing proposals for new power stations and thus any proposals submitted are therefore expected to show that the developer has actively explored the opportunities for CHP use.

8.4.22 Where heat opportunities have been identified, developers are required to show how they have dealt with these in shaping their proposals.

8.4.23 The Guidance suggests a number of potential heat markets as being worthy of consideration in CHP assessments undertaken by developers, either singly or in combination. In addition, the Guidance suggests that developers contact Trade Associations, Business Organisations and other interested parties to explore CHP opportunities.

8.4.24 The organisations contacted as part of the CHP Assessment for GEC included:

- The Carbon Trust;
- CHPA (Combined Heat and Power Association);
- CHPQA (Quality Assurance for Combined Heat and Power);
- CPI (Confederation of Paper Industries);
- DECC – Electricity Consents Team;
- DEFRA – CHP Policy: Renewables and Low Carbon Energy Team
- East of England Development Agency;
- East of England Strategic Health Authority;
- The Energy Saving Trust;
- Government Office for the East of England;
- HM Prisons Service: Property Services Group;
- Petroplus; and
- London Gateway / DP World.

CHP Assessment Conclusions

8.4.25 The following provides a summary of the potential CHP opportunities that were identified in the CHP Assessment:

- London Gateway / DP World

  Identified two potential LG Business and Logistics Park opportunities: one requiring steam; and, one proposing to operate a cold-store. However, neither opportunity has advanced to the stage where detailed information is available for use in this CHP Assessment.

Potential scenarios are modelled in the CHP Assessment.

- Petroplus

  Identified that CHP opportunities were available. However, were unable to provide any details for modelling within this CHP Assessment. Ongoing discussions are likely to continue as the GEC development progresses.

- CHPQA

  Examine the On-line Industrial Heat Map at http://www.industrialheatmap.com/

  Potential scenarios obtained from the On-line Industrial Heat Map are modelled in the CHP Assessment.

- CHPA

  Examine the on-line London heat map at http://www.londonheatmap.org.uk/

  The GEC site location is outside the coverage range of the London Heat Map.

- The Energy Saving Trust

  Provided actual gas consumption data (based on 2007 annual consumption figures) for domestic and industrial customers within the Thurrock Local Authority area, with specific reference to ‘Middle Layer Super Output Areas’: Thurrock 001; Thurrock 002; Thurrock 003; and, Thurrock 005.

  These areas are within 3 km radius of GEC site location.

  The data is based on actual meter readings. It is expected that 95 per cent of metered gas consumption will be due to heat demand (both space heating and water heating).

  Based on these assumptions, an estimate of local district heat demand of 22 MW is obtained. This is discussed further in the CHP Assessment.

  The scenarios considered in the CHP Assessment are

  - Provision of steam or hot water, or for use for refrigeration stores in the LG Development;
  - Use by Ford Motor Company at Dunton;
  - Use by Basildon Hospital; and
  - Local community heating.

Design and Access Statement

Guidance Requirements

8.4.26 A Design and Access Statement (DAS) was prepared in support of the Section 36 consent application to demonstrate that GECL had fully considered the design and access issues surrounding GEC in accordance with Section 3 of the Government Circular ‘Guidance on Changes to the Development Control System’ (August 2006).

8.4.27 This Guidance advises that the DAS should cover both the design principles and concepts which have been applied to GEC and how issues relating to access to GEC have been dealt with.

8.4.28 The Guidance also acknowledges that the DAS must be "proportionate" to the complexity of the application.

Design and Access Statement Conclusions

8.4.29 In line with the Guidance, the DAS for GEC covered the following issues:

- Development Description

This included a description of how GEC fits into the physical, social, economic and planning policy context of the local area. In addition, discussion was provided on the appropriateness of use of GEC.

- Development Amount

  This included discussion on how much development would be built on the application site.

- Development Design

  This included discussion on the amount, use, layout, scale, landscaping and appearance of GEC.

- Access Arrangements

  This presented information on the access arrangements to GEC, including those access arrangements required during construction and operation, in addition to inclusive (human) access.

8.5 Future Consultations

8.5.1 On completion of the ES and submission of the Section 36 consent application, GECL must publicise the application by placing a notice within: 2 newspapers available in the locality of GEC; a national newspaper; and the London Gazette.

8.5.2 Public notices will also be placed at a number of locations within the vicinity of the GEC site. Copies of the ES will be made available at key locations within the area, including Thurrock District Council, TTGDC, Corringham Library and Stanford-le-Hope Library, so that members of the public may view the ES and make any representations on the application.

8.5.3 TTGDC will also place a copy of the ES on their Planning Register together with any related documents. Within four months of the application being received, TTGDC will communicate their views on the application to DECC, who will subsequently make a decision on whether or not to give consent to GEC.

8.5.4 Throughout the determination process, GECL will continue to address any questions or concerns raised by stakeholders with regard to GEC.

SECTION 9

AIR QUALITY

9 AIR QUALITY

9.1 Summary

9.1.1 During construction, dust may be generated during several activities should preventative measures not be taken. However, it is very unlikely (during most weather conditions) that dust generated at the GEC site will cause a nuisance at sensitive receptors in the area. This is due to the distance of the sensitive receptors from the GEC site and the proposed mitigation measures that will be employed.

9.1.2 During normal operation, the principal atmospheric emissions of concern will be nitrogen oxides (NO_x). Levels of NO_x emissions will be maintained below 50 mg/Nm^3 as required by the Large Combustion Plant Directive (Directive 2001/80/EC) (LCPD) using Dry Low NO_x (DLN) Combustion technology. During times where supplementary (duct) firing is employed the NO_x emissions level may increase slightly to no more than 64.4 mg/Nm^3.

9.1.3 The GEC may also include a number of auxiliary boilers used to raise steam for back up to any CHP system. These auxiliary boilers would likely only operate when the CCGT plant was not in operation to provide steam to any customers in the surrounding area.

9.1.4 During normal operations a plume from the stacks will not be visible.

9.1.5 There are a number of automatic monitoring sites in the area the record ambient air quality data with regard to pollutants included in the UK National Air Quality Strategy (NAQS). The results from these sites have indicated that air quality in the area of the GEC site is generally good, although some pockets of poor air quality persist. As such, Thurrock District Council has declared 15 Air Quality Management Area (AQMA), comprising several ribbons, clusters and isolated properties which are close to the busiest roads in Thurrock. All 15 of these areas are declared with respect to nitrogen dioxide (NO_2). Four of the 15 are also declared with respect to particulate matter (PM).

9.1.6 As part of the impact assessment, a dispersion modelling exercise has been undertaken. Emissions of NO_2 from GEC have been modelled to predict the maximum average ground level NO_2 concentrations. These concentrations were compared to the relevant NAQS standards whilst also considering the existing background levels.

9.1.7 A conservative view of the operation of GEC was adopted in the modelling so that a likely ‘worst case’ scenario is presented. The purpose of using this conservative approach is to ensure that the maximum predicted impact within the potential operating regime of GEC is considered. This ensures that there is a ‘factor of safety’ built into the impact assessment.

9.1.8 Key findings from the assessment are:

- GEC will not give rise to high ground level concentrations of NO_2.
- The predicted maximum increase in long-term (annual average) ground level NO_2 concentrations due to the operation of GEC is 0.3 µg/m^3. This is well within the long-term NAQS objective of 40 µg/m^3. The maximum long-term ground level NO_2 concentration occurs at a point just over 1.2 km to the north east of the GEC site.
- The predicted maximum increase in short-term (19th highest hourly average) ground level NO_2 concentrations due to the operation of GEC is 12.0 µg/m^3. This is approximately 6 per cent of the short-term NAQS objective of 200 µg/m^3. The maximum short-term ground level NO_2 concentration occurs at a point just over 1.2 km to the north east of the GEC site.
- In addition, operation of GEC will not significantly increase ground level NO_2 concentrations at the various monitoring locations and AQMA in the area.

- As such, when considered along with the existing ground level concentrations in the surrounding area, it is not considered that GEC will give rise to any additional exceedences of any of the relevant NAQS objectives.

9.1.9 Therefore, it was concluded that the impacts of the atmospheric emissions from GEC will be well within the NAQS objectives even when considered in conjunction with the existing background levels.

9.1.10 GEC may potentially have a positive net effect on climate change as it will likely replace other fossil fuel sources of electricity generation that have greater CO_2 emissions per unit output.

9.1.11 In addition, GEC will be designed so as to be CCR, with space made available in the design to allow for the retrofitting of a carbon capture plant in the future. This is discussed further in the CCR Feasibility Study.

9.2 Introduction

9.2.1 This Section presents the air quality impact assessment, and includes:

- Details of the assessment methodology and significance criteria adopted in undertaking the assessment;
- The baseline conditions on which GEC's impact is assessed;
- The likely potential (pre-mitigation) significant environmental impacts which GEC may have;
- The mitigation measures to be adopted; and
- The resultant residual (post-mitigation) significant environmental impacts of the construction and operation of GEC.

9.2.2 Cumulative residual impacts are also considered within this Section.

9.3 Key Planning Policies

9.3.1 Section 3 provides the planning policy content. The policies listed below have informed the assessment process, to which reference has been made in Section 3. A full transcript of these policies is contained in Volume 2 Appendix A.

East of England Plan

SS1	Achieving Sustainable Development
ENV7	Quality in the Built Environment
ENG1	Carbon Dioxide Emissions and Energy Performance

9.4 Assessment Methodology and Significance Criteria

Assessment Methodology

9.4.1 The air quality impact assessment is based on the predicted contributions to ground level concentrations of pollutants. This is a requirement of the Environment Act 1995 and the NAQS, which have set standards and objectives for these ambient concentrations.

9.4.2 As such, the impact assessment follows the following methodology:

- Existing air quality in the vicinity of the GEC site has been derived from a number of potential sources of baseline data;
- Potential sources of air pollutants have been identified and, where relevant, quantified;
- Impacts of the identified emissions on the existing air quality in the vicinity of the GEC site have been predicted and, where possible, their significance evaluated;
- A description of the likely significant effects of GEC on air quality has been made; and
- Where necessary, proposals for mitigation have been suggested.

- Air quality impacts associated with construction and operational traffic are considered to be minimal and have not been considered further in the EIA.

Significance Criteria

9.4.3 The Significance Criteria adopted in this impact assessment have been derived from the criteria suggested by the National Society for Clean Air (NSCA) (now Environmental Protection UK) in their document Development Control: Planning and Air Quality (2006)[9].

9.4.4 Firstly the magnitude of potential impact is determined via Table 9.1.

TABLE 9.1: ESTABLISHING THE MAGNITUDE OF THE POTENTIAL IMPACT

Magnitude	*Increase in Annual Mean NO_2*	*Increase in Days NO_2 >200 µg/m^{3}**
Very Large	>25%	>14 days
Large	15-25%	8-14 days
Medium	10-15%	5-8 days
Small	5-10%	3-5 days
Very Small	1-5%	1-3 days
Extremely Small	<1%	<1 day
*Note: 18 days of exceedences are permitted under the NAQS in any one year		

9.4.5 The magnitude of the potential impact is then compared against the absolute concentration relative to NAQS Standard / Objective to determine the Significance via Table 9.2.

TABLE 9.2: ESTABLISHING THE SIGNIFICANCE OF THE PREDICTED IMPACT

Absolute Concentration in relation to Standard / Objective	**Magnitude**					
	Extremely Small	***Very Small***	***Small***	***Medium***	***Large***	***Very Large***
Decrease with Scheme						
Above Standard with Scheme	Slight Beneficial	Slight Beneficial	Substantial Beneficial	Substantial Beneficial	Very Substantial Beneficial	Very Substantial Beneficial
Above Standard without Scheme Below with Scheme	Slight Beneficial	Moderate Beneficial	Substantial Beneficial	Substantial Beneficial	Very Substantial Beneficial	Very Substantial Beneficial
Below Standard with Scheme, but not Well Below*	Negligible	Slight Beneficial	Slight Beneficial	Moderate Beneficial	Moderate Beneficial	Substantial Beneficial
Well Below Standard without Scheme	Negligible	Negligible	Slight Beneficial	Slight Beneficial	Slight Beneficial	Moderate Beneficial
Increase with Scheme						
Above Standard without Scheme	Slight Adverse	Slight Adverse	Substantial Adverse	Substantial Adverse	Very Substantial Adverse	Very Substantial Adverse

[9] *Development Control: Planning and Air Quality – 2006 Update. National Society for Clean Air, September 2006*

Absolute Concentration in relation to Standard / Objective	Magnitude					
	Extremely Small	*Very Small*	*Small*	*Medium*	*Large*	*Very Large*
Below Standard without Scheme Above with Scheme	Slight Adverse	Moderate Adverse	Substantial Adverse	Substantial Adverse	Very Substantial Adverse	Very Substantial Adverse
Below Standard with Scheme, but not Well Below*	Negligible	Slight Adverse	Slight Adverse	Moderate Adverse	Moderate Adverse	Substantial Adverse
Well Below Standard without Scheme	Negligible	Negligible	Slight Adverse	Slight Adverse	Slight Adverse	Moderate Adverse
Note: Well below the standard = <75% of the standard level 'Standard' relates to the specific air quality objective						

9.4.6 These Significance Criteria will be applied for the purposes of this impact assessment though it is noted that the NAQS method does not distinguish between processes or the extent of the area of impact.

9.4.7 Whilst these criteria will be referenced it is therefore important that results are seen in a qualitative rather than a quantitative light.

9.5 Baseline Conditions and Receptors

Ambient Air Quality

9.5.1 The latest NAQS for England, Scotland, Wales and Northern Ireland was published in 2007 and specified a series of standards and objectives for air quality in the UK.

9.5.2 Given that GEC will be fired exclusively on natural gas the only pollutant relevant to the impact assessment is NO_2 with other pollutants being present in such small amounts as to be irrelevant.

9.5.3 The NAQS objectives for NO_2 are summarised in Table 9.3.

TABLE 9.3: UK NAQS OBJECTIVES FOR NO_2

Pollutant	*Concentration measured as*	*Date to be achieved and maintained thereafter*	*Objective (Ground Level Concentration) ($\mu g/m^3$)*	*Number of permitted Exceedences*
Nitrogen Dioxide (NO_2)	1 Hour Mean	31/12/2005	200	18
	Annual Mean	31/12/2005	40	-

9.5.4 The European Union (EU) has also set ambient air quality objectives for NO_2 (via the Air Quality Framework Directive (Directive 1996/62/EC) and the 1st Daughter Directive (Directive 1999/30/EC)). The objectives include the same limit values and numbers of permitted exceedences as the NAQS. However the deadline for meeting the EU objectives are later than those for the UK, requiring compliance by 1 January 2010.

9.5.5 In addition to the objectives identified above, the European Union has set ambient air quality guidelines for oxides of nitrogen (NO_x) for the protection of ecosystems. This imposes a long-term (annual average) limit for NO_X of 30 $\mu g/m^3$.

9.5.6 It is important to define the areas in which the limit for the protection of ecosystems is to be achieved. Directive 99/30/EC states that sampling points to determine concentrations should be:

- At least 5 km from major emission sources; or
- 20 km from an agglomeration (which is defined as an area with a population of more than 250 000); and
- Representative of areas of at least 1000 km^2.

9.5.7 Accordingly, the Government and devolved administrations intends that the long-term (annual average) limit for NO_X of 30 $\mu g/m^3$ for the protection of ecosystems applies in those parts of the UK that are:

- More than 20 km from an agglomeration;
- More than 5 km away from industrial sources regulated under Part A of the 1990 Environmental Protection Act;
- More than 5 km from motorways; and
- Built up areas of more than 5000 people.

9.5.8 As such, due to the nature of land use in the surrounding area, the long-term (annual average) limit for NO_X of 30 $\mu g/m^3$ for the protection of ecosystems does not apply anywhere within the likely sphere of influence of GEC. Nevertheless, the impact of GEC has been benchmarked against these requirements, and further discussion on GEC's impacts to ecologically sensitive sites is included in Section 12 – Ecology.

9.5.9 Essentially, receptors relevant to the impact assessment exist anywhere outside the confines of the GEC site. However, receptors that are especially relevant are local residences where people spend a large percentage of their time. The nearest residential and sensitive area is Oozedam Farm, approximately 1 km to the north east of the GEC site. The nearest residential settlements are at Corringham, Canvey Island and Basildon which lie approximately 4 km to the west, 5 km to the east and 7 km to the north respectively.

9.5.10 In addition, as it is important that GEC does not lead to either the exacerbation of existing air quality problems encountered in the area, other receptors that must be given special consideration include Air Quality Management Areas (AQMAs) as designated by the Local Council and areas of poor air quality.

9.5.11 Baseline conditions can be determined by examining Local Authority ambient air quality data. Local Authorities have duties under Part IV of the Environment Act 1995 to assess air quality within their administrative areas. Full details of the duties are set out in the NAQS.

9.5.12 If pollutant levels are likely to exceed statutory objectives, then they must declare an AQMA and draft an Action Plan to achieve the statutory objectives. The Department of Environment Transport and the Regions (DETR) (now Department for Transport) have issued technical guidance to the Local Authorities to assist in undertaking this task. The process comprises three stages:

- Stage 1 is intended to assist the Local Authority in determining which existing and proposed sources may have a significant impact on air quality.
- Stage 2 is intended to provide additional screening of pollutant concentrations in the area and determine the risk of non-compliance with the air quality objective by the relevant future year.
- Stage 3 entails a detailed and accurate appraisal of the potential impacts of the outcome of Stages 1 and 2. From this appraisal, the authority is required to determine both the magnitude and the geographical extent of any likely exceedences of the objectives.

9.5.13 At the end of the three stage process the Local Authority should have identified areas where there are likely exceedences of the statutory objectives and for each pollutant calculate:

- How great an improvement is needed to meet the objectives; and
- The extent to which different sources contribute to the problem.

9.5.14 This gives the Local Authority a clear picture of the sources which can be controlled or influenced, and aid the Local Authority to target more effectively the relative contributions of industry, transport and other sectors and ensure that the solutions are cost effective and proportionate when producing their Action Plan.

9.5.15 As part of the ongoing review and assessment process of AQMAs, a phased approach has been adopted to ensure that the level of assessment is commensurate with the risk of an air quality objective being exceeded. Therefore, each Local Authority is required to undertake an Updating and Screening Assessment (USA) of the AQMAs in their administrative area in order to identify changes which have occurred since the previous review and assessment and which could potentially lead to a risk of an air quality objective being exceeded. Where a risk has been identified the local authority is required to undertake a more detailed assessment to determine the likelihood of an exceedance and revise the AQMA as appropriate. The last USA, undertaken by Thurrock District Council, was published in April 2009[10].

9.5.16 Detailed in the April 2009 USA were15 AQMAs in the Thurrock District Council area. These are detailed in Table 9.4.

TABLE 9.4: SUMMARY OF THURROCK DISTRICT COUNCIL AQMA

	Pollutant	***Description***
1	NO_2	Grays Town Centre and London Road Grays
2	NO_2	London Road South Stifford and adjoining roads
3	NO_2	East side of Hogg Lane and Elizabeth Road
4	NO_2	West of Chafford Hundred Visitor Centre
5	NO_2 and PM_{10}	Warren Terrace, A13 and A1306
7	NO_2 and PM_{10}	Hotels next to M25
8	NO_2 and PM_{10}	Hotel next to Junction 31 of M25
9	NO_2	Hotel next to Junction 31 of M25
10	NO_2 and PM_{10}	London Road Purfleet near to Jarrah Cottages
12	NO_2	Watts Wood estate next to A1306
13	NO_2	London Road Averley next to A1306
15	NO_2	Near to M25 on edge of Irvine Gardens, South Ockendon
16	NO_2	Next to M25 off Dennis Road
21	NO_2	Hotel on Stonehouse Lane
23	NO_2	London Road West Thurrock

9.5.17 As can be seen from the Table, the AQMAs lie along the routes of busy roads in the area. As such, the areas designated are fairly small and will primarily be the result of pollution from road traffic.

[10] *Thurrock Council – Updating and Screening Assessment (April 2009)*

9.5.18 There are a number of automatic monitoring stations that are or have been operated on behalf of DEFRA in the UK. The results from the monitoring sites are available on the Internet.

9.5.19 There are four monitoring stations in the vicinity of the GEC site. These monitoring stations have been in operation for a number of years and have been recording data, which will include contributions from both the existing CECL Power Station and the Coryton Oil Refinery.

9.5.20 Annual average NO_2 concentrations for the years 2004 to 2008 is shown in Table 9.5, and maximum 19^{th} highest hourly average concentrations are shown in Table 9.6.

9.5.21 The locations of the automatic monitoring stations in relation to the GEC site are shown in Figure 9.1.

TABLE 9.5: ANNUAL AVERAGE CONCENTRATIONS OF NO_2 FROM AUTOMATIC MONITORING STATIONS ($\mu g/m^3$)

	Stanford-le-Hope	***Rochester-Stoke***	***Thurrock***	***Southend-on-Sea***
Type	Kerbside	Rural	Urban Background	Rural
Distance from GEC Site (km)	3.9	11.6	12.9	13.0
2008	37.1	17.8	32.0	22.8
2007	-	18.4	34.0	24.8
2006	-	19.8	32.9	20.5
2005	-	18.8	34.8	23.5
2004	-	20.5	35.5	23.7
AQS	40	40	40	40

TABLE 9.6: MAXIMUM 19TH HIGHEST HOURLY AVERAGE CONCENTRATIONS OF NO_2 FROM AUTOMATIC MONITORING STATIONS ($\mu g/m^3$)

	Stanford-le-Hope	***Rochester-Stoke***	***Thurrock***	***Southend-on-Sea***
Type	Kerbside	Rural	Urban Background	Rural
Distance from GEC Site (km)	3.9	11.6	12.9	13.0
2008	130	73.5	107.0	94.0
2007	-	85.6	136.0	115.0
2006	-	82.5	113.0	88.0
2005	-	75.3	101.0	86.0
2004	-	75.8	103.0	78.0
AQS	200	200	200	200

9.5.22 In addition to the above permanent monitoring stations, Thurrock District Council has undertaken diffusion tube sampling for NO_2 at a number of locations. Five of these sampling locations were included in the NO_2 Diffusion Tube Network operated on behalf of DEFRA. The NO_2 Diffusion Tube Network was a co-operative effort between DEFRA and Local Authorities within the UK to map spatial and temporal trends in NO_2 concentrations. The data from these five locations is presented in Table 9.7.

9.5.23 The locations of the NO_2 Diffusion Tube Network monitoring stations in relation to the GEC site are shown in Figure 9.1.

TABLE 9.7: ANNUAL AVERAGE CONCENTRATIONS OF NO_2 FROM NO_2 DIFFUSION TUBE NETWORK MONITORING STATIONS ($\mu g/m^3$)

	GRAYS 1N	*GRAYS 2N*	*GRAYS 3N*	*GRAYS 4N*	*GRAYS 5N*
Type	Roadside	Intermediate	Urban Background	Urban Background	Roadside
Distance from GEC Site (km)	12.4	12.3	11.6	13.0	13.8
2008	46.7	-	29.0	26.6	64.9
2007	53.1	-	37.3	29.1	72.0
2006	53.3	-	35.9	28.6	68.7
2005	48.4	-	37.6	26.8	65.2
2004	49.3	-	33.6	27.6	66.2
2003	60.3	-	31.4	30.8	71.1
2002	58.3	-	33.6	30.6	61.1
2001	57.1	-	32.7	31.1	58.6
2000	53.7	53.1	29.0	30.9	-
AQS	40	40	40	40	40

9.5.24 The locations of the diffusions tubes are noted in the Table. This Table would indicate that significantly higher annual NO_2 concentrations are found adjacent to roads rather than for other urban areas. This is to be expected as traffic will generate NO_2 through the combustion of liquid fuels. However, it should be noted that these results are not representative of the experience of members of the general public.

9.5.25 In addition, Table 9.8 gives detail of the maximum annual ground level concentrations estimated for Thurrock District Council by NETCEN including NO_2 projections for the years 2009, 2010, 2015 and 2020. It should be noted that the projections for 2015 are especially relevant given the projected date for commercial operation.

9.5.26 The table shows a predicted improvement in ground level concentrations of NO_2 over the coming years.

TABLE 9.8: ANNUAL POLLUTANT LEVELS ESTIMATED FOR LOCAL COUNCILS ($\mu g/m^3$)

Pollutant	*Year*	*Thurrock District Council*	
		Maximum	*Average*
NO_2	2009	40.9	22.4
	2010	39.5	21.6
	2015	34.2	19.0
	2020	31.9	16.8

9.5.27 The above Tables demonstrate that, save for the annual concentrations recorded by the roadside NO_2 Diffusion Tube Network monitoring stations, levels of NO_2 are not close to exceeding wither the long-term or short-term objectives adopted in the NAQS.

9.6 Potential Impacts

9.6.1 This subsection reviews the potential air pollution generated by the construction and operation of GEC.

Construction

9.6.2 Dust may be generated during several activities associated with the construction works should preventative measures not be taken. Dust could arise from:

- Earth moving operations for site levelling (that will be minimal);
- Back filling and foundations;
- Removal of spoil, site stripping, blow-off and spillage from vehicles;
- Concreting operations;
- Site reinstatement;
- Road construction; and,
- During wind blow over bare dry construction areas.

9.6.3 Only with high wind speeds, where more dust could be created at the source, would long distance transport of dust and the potential for soiling of buildings occur. As such, the extent of any such emissions of dust is very dependent on wind speed, ground conditions, the prevalence of hot, dry conditions and the use of preventative measures.

9.6.4 The dust particles that may be emitted during construction would be of large diameter and would therefore tend to resettle on the ground within 100 to 500 m of the GEC site. Approximately 70 per cent of the dust would generally settle out of the atmosphere within 200 m of the source, and less than 10 per cent could be expected to remain at a distance of 400 m. As the nearest residential properties are located over 1 km from the GEC site, impacts associated with dust creation should be minimal.

9.6.5 In addition, impacts may be further minimised by the buildings lying between the GEC site and the nearest residences, including those of the LG Development, meaning that soiling of residential buildings is unlikely to occur.

9.6.6 Dust emissions from the GEC site will not be more onerous than those normally encountered on construction sites. Nevertheless, during construction, GECL will require its contractors to adhere to the Building Research Establishment Guidance Document 'Control of Dust from Construction and Demolition Activities' (BR 456), and as such construction operations will be conducted so as to minimise the generation and spread of dust.

9.6.7 Additionally, GECL will require its contractors to implement a comprehensive mitigation and monitoring programme to prevent construction work generating levels of atmospheric dust that would constitute a health hazard or nuisance to people working on the GEC site or living nearby.

9.6.8 Also, the use of wheel and chassis washing units will help to prevent the transport of mud and dust onto off-site routes.

9.6.9 There is the potential for emissions of nitrogen oxides and other such pollutants to increase slightly as a result of the additional traffic generated during the construction phase. These will be controlled by minimising traffic movements where practical and ensuring vehicles are well maintained such that they do not produce any unnecessary emissions. Other measures such as ensuring engines are not left running unnecessarily will also be implemented as appropriate.

9.6.10 As the mitigation measures outlined below will be employed, dust is unlikely to result in any significant environmental impact during the construction phase.

9.6.11 Commissioning of each CCGT unit of GEC will take in the order of 16 weeks. The purpose of commissioning is to adjust the performance of the newly installed plant to achieve all required operational and environmental performance criteria. As firing of the gas turbines will be intermittent during this period, it is possible that during commissioning the emissions of nitrogen oxides (NO_x) will be temporarily higher than those during normal operation.

9.6.12 However, operational periods during commissioning are often short and operation is frequently at low load. Thus the total mass emissions of NO_x during these periods will be low and well within the relevant air quality limits.

Operation

9.6.13 Natural gas will be used as the fuel in the gas turbines. This is an inherently clean fuel which results in much lower NO_x, and trace SO_2, emissions when compared with other fuels such as oil or coal. In addition, natural gas has a higher hydrogen content and calorific value than oil or coal, which results in comparatively much lower CO2 emissions per unit of electricity generated.

9.6.14 Combustion in the gas turbines is conducted at high excess air rates, typically 200 to 300 per cent excess air. Therefore, there are very low levels of carbon monoxide (CO), unburnt carbon (i.e. particulate matter) or unburnt hydrocarbons present in the products of combustion.

9.6.15 As such, the combustion of natural gas results in the emission of flue gases containing CO_2, water vapour, oxygen, nitrogen, CO, NO_x and negligible traces of SO_2.

9.6.16 The Environment Agency, in their Technical Guidance Note H1 (Environmental Assessment and Appraisal of Best Available Techniques (BAT)), provide guidance to allow for the determination of whether detailed assessment, via dispersion modelling of various pollutants that will be emitted as part of the combustion process, is required.

9.6.17 The assessment methodology in Technical Guidance Note H1 imposes a high level calculation to determine the likely long and short term ground level concentrations that might arise from an installation based on the release rate of the pollutant to be assessed and a dispersion factor derived from the installation's stack height.

9.6.18 To determine the pollutants that should be considered as part of the more detailed dispersion modelling exercise, calculations have been undertaken using the methodology prescribed in Section 3.3.1 of the Technical Guidance Note H1 based on the stack height, emissions rates and parameters shown in Table 9.11. The results of these calculations showed the only emissions of concern from GEC are those of NO_2 with other pollutants not being present in sufficient quantities in the flue gases to pose a potential significant impact to local air quality.

9.6.19 The contribution to ground level concentrations of NO_2 due to operation of GEC have been quantitatively assessed using dispersion modelling techniques and have been compared with the background air quality in the area and with EU legislation and UK guidelines.

9.6.20 In addition, the total emissions of NO_x from the gas turbines at GEC will be below 50 mg/Nm^3 at reference conditions when the gas turbine is operating at greater than 70 per cent of the rated output in accordance with the requirements of the Large Combustion Plant Directive 'new' new plant standard for gas turbines. GECL will require the manufacturer to guarantee these NO_x emissions levels.

9.6.21 During normal operations a plume from the stacks will not be visible.

9.6.22 All environmental controls at the plant and all emissions will comply with the conditions and limits set by the Environment Agency in the Environmental Permit (EP) to operate GEC.

Control of Oxides of Nitrogen during Combustion

9.6.23 The formation of oxides of nitrogen during the combustion of fossil fuels is unavoidable. NO is the principal oxide of nitrogen produced, with a small proportion of NO_2. The ratio of formation of NO_2 to NO is approximately 1:19.

9.6.24 When NO_x was first identified as a harmful pollutant, the exhausts of gas turbines typically contained approximately 280 to 470 mg/Nm^3 NO_x. After this problem had been identified, the manufacturers of gas turbines were able to reduce the levels of NO_x to around 235 mg/Nm^3 by fairly simple changes to air and fuel distribution in the combustors.

9.6.25 Since the NO_x formation from atmospheric nitrogen is strongly dependent on the maximum flame temperature and also the time the hot gases remain at this temperature, the thermal NO_x component can be reduced either by cooling the flames by the injection of steam or water into the combustion zone or by the use of DLN Combustion technology.

9.6.26 For GEC, it is proposed that the emissions of NO_x from the gas turbines will be controlled by the use of DLN Combustion technology. As such, the concentrations of NO_x in the exhaust gases at the exit from the gas turbines will therefore not exceed 50 mg/Nm^3 during normal operation rising to 64.4 mg/Nm^3 when the plant employs supplementary firing.

9.6.27 DLN Combustion technology comprises either pre-mix or hybrid burners, which burn fuel with excess air and maintain the fuel : air ratio across the load range. The main volume of combustion air is supplied to dilute the flame and inhibit further NO_x formation.

9.6.28 As flame stability cannot be maintained during periods of low load or start-up the formation of NO_x cannot be reduced at these times. Therefore, for short periods during start-up (about 180 minutes for typical start-up, increasing to about 6 hours for start-ups after an infrequent lengthy outage) and shut-down (about 60 minutes for typical shut-down), the DLN Combustion technology would not be effective. During these periods, NO_x concentrations would be increased, however the volumetric flow of the flue gases is significantly reduced. Therefore, the mass emissions, and resulting impact, will not be significant. As such, this will not challenge the relevant air quality limits.

Conversion of Nitric Oxide to Nitrogen Dioxide

9.6.29 NO_x emissions from GEC will consist of the gases NO and NO_2. In terms of direct health and environmental effects it is only NO_2 that is of concern, however as NO is a source of NO_2 in the atmosphere it must also be considered. Generally, NO and NO_2 are in equilibrium in the air, with NO predominating at the stack exit. As the plume cools, the equilibrium changes which results in a predominance of NO_2.

9.6.30 NO is oxidised to NO_2 mainly by reaction with ozone. Within 5 km of the source less than 20 per cent of the NO will have converted to NO_2 under stable conditions. Under unstable conditions (with more atmospheric mixing) up to 50 per cent of the NO may have converted to NO_2.

9.6.31 For assessing the impacts on air quality of emissions to atmosphere from large combustion sources, such as gas-fuelled power stations, it is important that realistic estimates are made of how much NO would be oxidised to NO_2 at all receptors considered.

9.6.32 The rate of oxidation of NO to NO_2 depends on both the chemical reaction rates and the dispersion of the plume in the atmosphere. The oxidation rate is dependent on a number of factors that include the prevailing concentration of ozone, the wind speed, solar radiation and the atmospheric stability.

9.6.33 Between 1975 and 1985 about 60 sets of measurements were made of the concentrations of NO and NO_2 in various power station plumes. These measurements were carried out under widely varying weather conditions at altitudes between 200 m and 700 m. From the data collected it was found that an empirical relationship for the percentage oxidation in a power station plume based on downwind distance, season of the year, wind speed and ambient ozone concentration may be described by an equation. This equation, sometime referred to as Janssen's Equation, is shown here:

$$\frac{NO_2}{NO_x} = A\left(1 - exp^{(-\alpha x)}\right)$$

Where: x is the distance downwind (km) of the emission point; and;

α and A – are constants dependent on time of year and derived from the measurements of wind speed and ozone concentrations.

9.6.34 For a typical gas fired power station, the peak ground level concentration of NO_x will occur within a few kilometres downwind of the stacks. As such, the above empirical relationship has been used to estimate the percentage oxidation for each hour during the years 2004 to 2008 at increasing downwind distances from GEC. These estimates were made using hourly averaged meteorological data from Southend Airport.

9.6.35 The oxidation rates are calculated on an hourly basis so that the time of year / season is taken into account in the calculations.

9.6.36 Table 9.9 shows the minimum (lowest), maximum (highest) and annual one hour average estimates of NO_2 in the plume for selected distances downwind. The estimates take into account the ratio of NO to NO_2 in the plume on exit from the stack.

TABLE 9.9: ESTIMATES OF THE PERCENTAGE OF NO_2 IN NO_X

Downwind Distance (km)	*Percentage NO_2*		
	Lowest One Hour Average	*Highest One Hour Average*	*Annual One Hour Average*
1	6	16	9
2	11	29	18
3	17	40	25
5	26	56	37
10	44	76	56

9.6.37 Based on the principles outlined in Table 9.9 above, the average conversion of NO to NO_2 at distances of 2 km from the stack is predicted to be 18 per cent. The highest percentage oxidation for any hour during 2004 to 2008 for impacts that occur within 2 km of the stack is 29 per cent. The predictions also suggest that out to distances of 3 km from the GEC site, the percentage oxidation of NO to NO_2 in the plume will on average be just over 25 per cent.

9.6.38 The maximum conversion factor calculated for each receptor can been applied to the predicted levels of NO_x due to GEC to give a conservative estimate of NO_2 contributions at each individual receptor based on the data in Table 9.9 and the distance of the receptor from the stack. As part of the calculation of the conversion, the centre point between the two stacks at GEC will be used as the reference point for the conversion.

Atmospheric Dispersion Modelling

9.6.39 Atmospheric dispersion modelling can predict the ground level concentrations that occur due to the emissions from an elevated stack point source. This subsection describes the key aspects of the dispersion modelling process.

9.6.40 When flue gases are discharged from a stack they have two sources of momentum.

9.6.41 The first source of momentum is related to the velocity of discharge. This is usually designed to be in excess of 15 metres per second (m/s) as this value has been found to be sufficient to avoid immediate downwash of the plume. The momentum from the velocity of discharge is soon dissipated.

9.6.42 The second source of momentum is much more significant and is related to the discharge temperature of the flue gases. As the flue gases are warmer than the surrounding atmosphere into which they are discharged, they have buoyancy and therefore rise. This process continues until the flue gases have cooled to the same temperature as the surrounding air.

9.6.43 Mathematical models calculate the effects of these two sources of momentum and determine the height to which the flue gases will rise. This height plus the height of the chimney gives an effective chimney height.

9.6.44 The mathematical model then determines the dispersion of the flue gases from this effective chimney height. It should be noted that the effective chimney height can be many times greater than the actual chimney height due to the large amount of heat present in the flue gases.

9.6.45 Dispersion occurs as a result of turbulence, and turbulence can result from two sources.

9.6.46 The first source of turbulence to aid dispersion of flue gases is via buoyancy effect. As an example of buoyancy effects, on a sunny day solar heating creates turbulence as the ground is heated and the air near the ground rises as its buoyancy is increased. This effect is similar to the thermals experienced by small plane and glider pilots on sunny days. Buoyancy effects can rapidly disperse a plume into the surrounding air. The opposite effect is observed at night, during stable conditions, where the buoyancy effect is to suppress rather than cause or enhance turbulence.

9.6.47 The second source of turbulence to aid dispersion of flue gases is wind shear, also known as mechanical effect. Wind shear effects, important to air pollution modelling, result from high (several meters per second) wind speeds near the ground. Since the wind speed at the ground is zero, any high wind speeds result in substantial wind shear.

9.6.48 Wind shear dominates over buoyancy effects not only under high wind conditions, but also near the ground under any conditions. As a result of this, two parameters are used to define the 'stability' of the atmosphere and the balance between the buoyancy effect and the wind shear effects.

9.6.49 The first parameter is the friction velocity which is a measure of wind shear. As shear stress per unit mass has the units of velocity squared, the square root of the shear stress is the friction velocity.

9.6.50 The second parameter is a stability term called the Monin-Obukhov length. As mentioned above, shear stress always dominates near the ground. The height above the ground where buoyancy effects begin to dominate (generating turbulence in convective conditions or suppressing turbulence in stable conditions) is called the Monin-Obukhov length. This can be thought of as a depth of the neutral (i.e. shear-dominated) flow.

9.6.51 The Monin-Obukhov length is positive for stable conditions, and negative for convective. Near-neutral conditions are characterised by very large negative, or very large, positive Monin-Obukhov lengths. Very stable conditions have Monin-Obukhov length of a few metres to a few tens of metres, while very unstable conditions have negative lengths of about the same size.

The Dispersion Model and Inputs

9.6.52 To gauge the impact of GEC, a dispersion modelling exercise has been undertaken. The dispersion models available and accepted by the UK Environment Agency for point sources are AERMOD and ADMS. Both are second generation models developed in the US and the UK respectively.

9.6.53 ADMS was selected for the dispersion modelling of GEC.

9.6.54 Downwash structures are those which subject the plume to wake effects. Their effect is generally to pull the plume down to the ground closer to the stack and not allow the plume to disperse as effectively, thus increasing ground level pollutant concentrations. Potential downwash structures are those which are located within 5L of the stack, where L is the lesser of either the height of the building or the maximum projected width of the building. An additional point to note is that if a stack is higher than the height of the building plus 1.5L, then the building is not classed as a downwash structure.

9.6.55 A list of the buildings included in the modelling undertaken is included in Table 9.10.

TABLE 9.10: DISPERSION MODELLING BUILDING DATA

Building	Height (m)	Angle	Dimension (m)		Location (centre)	
			X	Y	Easting	Northing
Turbine Hall	36.5	3	45	130	573140	181900
HRSG 1	42	3	40	20	573102	181945
HRSG 2	42	3	40	20	573104	181909
ACC	36	3	95	80	573220	181820
Aux Boiler (block of 3)*	10	3	40	20	573093	181756
			Diameter		Easting	Northing
Demin Water tank*	10	-	25		573081	181725
Raw Water tank*	10	-	25		573110	181784

*Included due to relevance to Boiler Stack Height determination

9.6.56 The ADMS model calculates time averaged ground level concentrations at any identified specific point. The modelling used Cartesian Grids of 4 km by 4 km and 20 km by 20 km with evenly spaced nodes to predict the ground level concentrations associated with the scenarios identified. These grids were centred on the GEC site (573103, 181927).

9.6.57 Following discussions with the EA, full detailed dispersion modelling was undertaken using meteorological data from Southend Airport. The data periods considered were the years 2004 to 2008. This meteorological data was chosen as the most recent available data in the vicinity of the GEC site.

9.6.58 For each year, the predominant wind direction was south west. The wind rose for the year 2008 can be seen in Figure 9.2.

9.6.59 Terrain effects generally occur when ground levels within 1 km of the stack vary by more than a third of the stack height. However, as the terrain in the study grids considered is undulating, although not mountainous, these effects have been modelled to ensure a robust assessment is undertaken.

Stack Height Sensitivity CCGT Units

9.6.60 A stack height investigation for the GEC CCGT stacks has been undertaken to identify the most appropriate stack height. The stack height sensitivity study examined stack heights of 50, 60, 70, 80 and 90 m, which are considered to represent a typical range for CCGT in the UK. Supplementary firing was assumed to be occurring for the hourly peak but not for the annual prediction as this mode of operation will be associated with steam generation and peak load operation which will likely seldom occur.

9.6.61 The stack height investigation predicted ground level concentrations of NO_2 to be compared with both the short and long terms NAQS objectives.

9.6.62 The short term objective for NO_2 is the concentration of 200 µg/m^3 measured as a 1 hour mean not to be exceeded more than 18 times per year. This was compared with the predicted 19th highest hourly average concentration of the year resulting from the operation of GEC.

9.6.63 The long term objective for NO_2 is the concentration of 40 µg/m^3 measured as an annual mean. This was compared with the annual average concentration resulting from the operation of GEC.

9.6.64 The stack height sensitivity study assumed that both gas turbines at GEC operated at full load for 93 per cent of the year which in actual fact is not likely to occur.

9.6.65 All years of meteorological data discussed above have been used for detailed analysis of the stack height. Details of the modelling input parameters for GEC can be found in Table 9.11.

TABLE 9.11: DISPERSION MODEL INPUTS CCGT UNITS

Parameter	***Units***	***Modelling Details per Unit***
Equivalent stack diameter	m	6.2
Supplementary Firing		
NO_x emission level*	mg/Nm^3	64.4
NO_x flow rate	g/s	38.4
Flue gas temperature	°C	82.1
Actual flue gas volume	m^3/s	744
Normal flue gas volume	Nm^3/s	595
Oxygen content	%	11.0
Flue gas velocity	m/s	25.0
No Supplementary Firing		
NO_x emission level	mg/Nm^3	50
NO_x flow rate	g/s	29.6
Flue gas temperature	°C	85.4
Actual flue gas volume	m^3/s	751
Normal flue gas volume	Nm^3/s	592
Oxygen content	%	12.2
Flue gas velocity	m/s	25.0

NOTE: emission rates and levels are referenced at 15 per cent.
**Emissions level for Supplementary firing calculated using the methodology detailed in "Chief Inspector's guidance to inspectors Environmental Protection Act 1990 Process Guidance Note IPR 1 /2 (Revised 1994)" Annex 1 "supplementary firing".*

9.6.66 The stacks were assumed to be located at Grid Ref 573076.5, 181943.5 for Stack 1 and Grid Ref 573078.5, 181908.0 for Stack 2.

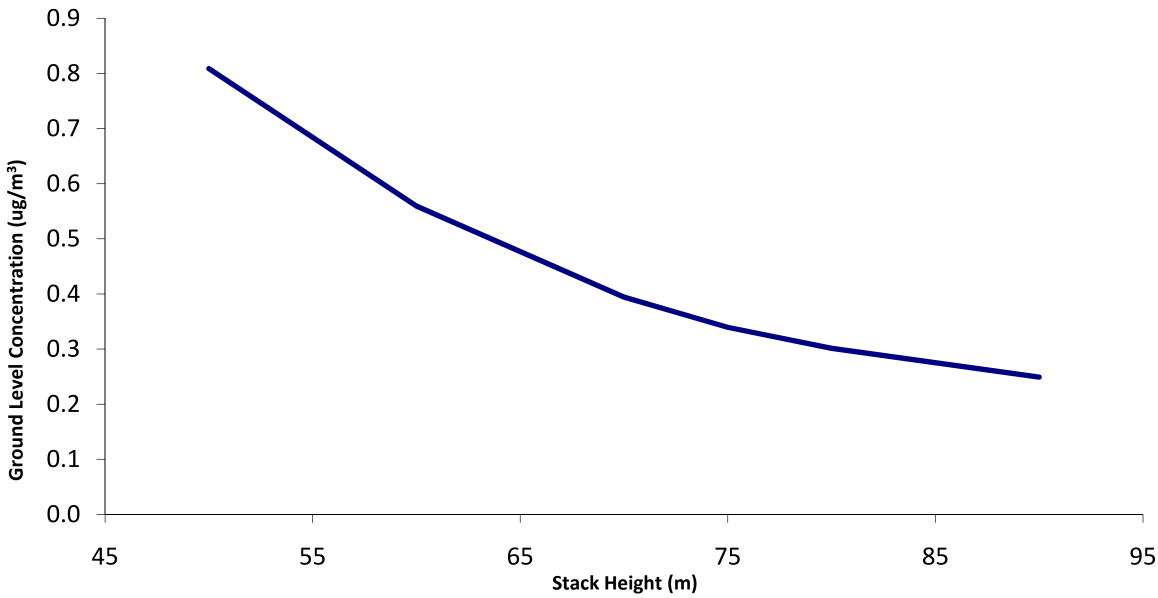
9.6.67 On the basis of comparison with NAQS objectives, the maximum 19th highest hourly average concentration and the annual average concentrations of NO_2 for each stack height was predicted and is shown in Table 9.12. The prediction assumed a conversion rate for NO_x to NO_2 based on the Jansen Equation, discussed in Paragraph 9.6.33 onwards. The predictions shown in Table 9.12 are the highest predictions using any of the five years of meteorological data.

TABLE 9.12: STACK HEIGHT SENSITIVITY FOR NO_2 (µg/m^3)

Stack Height	***Maximum 19th Highest Hourly Average Concentration***	***Annual Average Concentration***
50	19.2	0.8
60	16.3	0.6
70	13.1	0.4
75	12.0	0.3
80	11.1	0.3
90	9.1	0.2

9.6.68 The data in Table 9.12 is shown graphically in Insert 9.1 and Insert 9.2.

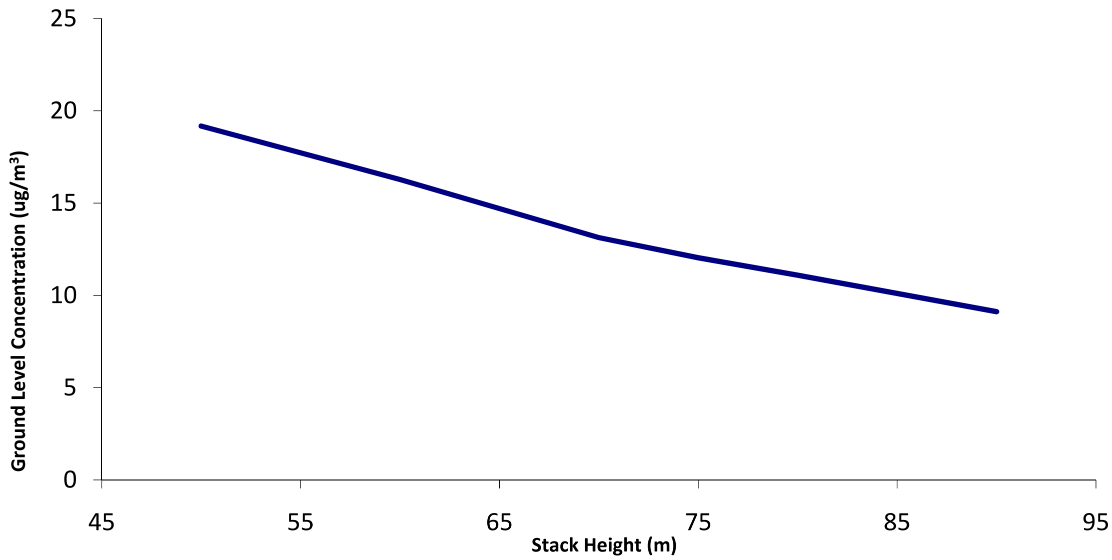
INSERT 9.1: STACK HEIGHT SENSITIVITY – MAXIMUM ANNUAL AVERAGE CONCENTRATION OF NO_2 (µg/m^3)



9.6.69 Insert 9.1 shows that the predicted maximum annual average concentration of NO_2 decreases with an increasing stack height.

9.6.70 The prediction crosses the EA's own threshold of potential significance (0.4 µg/m^3) at c. 70m with the graph showing a slow and steady benefit in stack height increases with regard to maximum annual average concentration.

INSERT 9.2: STACK HEIGHT SENSITIVITY – MAXIMUM 19TH HIGHEST HOURLY AVERAGE GROUND LEVEL CONCENTRATION (µg/m^3)



9.6.71 Insert 9.2 shows that the maximum predicted 19th highest hourly average concentration of NO_2 decreases with an increase in stack height.

9.6.72 Insert 9.2 indicates that as the more significant reductions in concentrations are shown as steeper gradients, greater reductions in concentrations are seen for shorter stack heights (less than c.70 m) with smaller savings for taller stack heights (greater than 65 m).

9.6.73 Therefore, based on the above stack height sensitivity 75 m stacks are preferred for the proposed GEC plant.

Stack Height Sensitivity of auxiliary boiler plant

9.6.74 A stack height investigation for the GEC auxiliary boiler stack has been undertaken to identify the most appropriate auxiliary boiler stack height. The auxiliary boiler stack height sensitivity study examined auxiliary boiler stack heights of 10, 15, 20 and 25 m. The auxiliary boiler has been assumed to seldom operate as this will likely only provide back up for the main CCGT units when these are out of service; the plant will designed with an average availability of 93 per cent.

9.6.75 As for the CCGT stack the auxiliary boiler stack height investigation predicted ground level concentrations of NO_2 to be compared with the NAQS objectives. However only the short term averaging period has been considered as the plant will seldom operate such that annual impacts are not of relevance in the auxiliary boiler stack height determination.

9.6.76 Details of the modelling input parameters for the auxiliary boiler plant can be found in Table 9.13.

TABLE 9.13: DISPERSION MODEL INPUTS BOILER PLANT

Parameter	*Units*	*Modelling Details*
NO_x emission level	mg/Nm^3	100
NO_x flow rate	g/s	14.6
Flue gas temperature	°C	198
Actual flue gas volume	m^3/s	288.1
Normal flue gas volume	Nm^3/s	138.1
Oxygen content	%	2.0
Flue gas velocity	m/s	25
Equivalent stack diameter	m	3.8

NOTE: Emission rates and levels are referenced at 3 per cent.

9.6.77 The stack was assumed to be located at Grid Ref 573094, 181740.

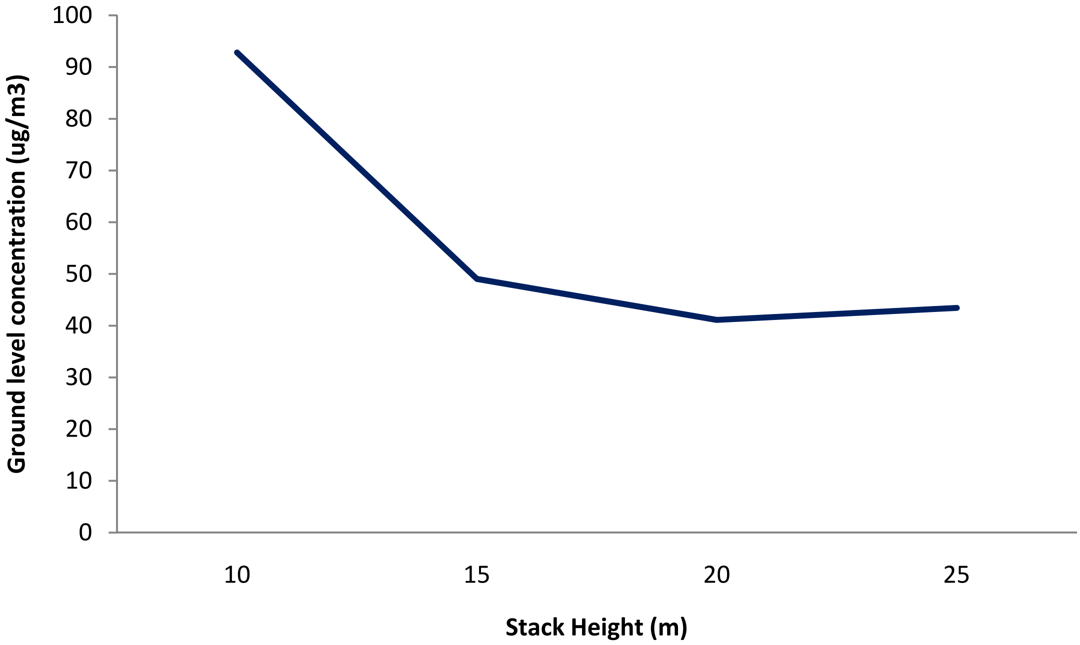
9.6.78 On the basis of comparison with NAQS objectives, the maximum 19th highest hourly average concentration and the annual average concentrations of NO_2 for the stack height was predicted and is shown in Table 9.14 The prediction assumed a conversion rate for NO_x to NO_2 based on the Jansen Equation, discussed in Paragraph 9.6.33 onwards. The predictions shown in Table 9.14 are the highest predictions using any of the five years of meteorological data.

TABLE 9.14: STACK HEIGHT SENSITIVITY FOR NO_2 (µg/m^3)

Stack Height	*Maximum 19th Highest Hourly Average Concentration*
10	92.8
15	49.0
20	41.1
25	43.4

9.6.79 The data in Table 9.12 is shown graphically in Insert 9.3.

INSERT 9.3: STACK HEIGHT SENSITIVITY – MAXIMUM HOURLY CONCENTRATION OF NO_2 (µg/m^3)



9.6.80 Insert 9.3 shows that the predicted maximum hourly concentration of NO_2 decreases with an increasing stack height up to a point where levels start to increase again, no doubt due to downwash interactions with some of the larger items of plant and also greater conversion as the plume travels further from the plant.

9.6.81 The Insert shows that there is little benefit in employing an auxiliary boiler stack greater than 15 m and so a 15m stack is proposed to be employed. In examining the figures it is important to note that as the boiler plant will likely seldom operate the potential for the plant to operate at the same time as the worst case met conditions occur is slight and as such the predicted impacts represent a significantly conservative estimate.

Detailed Dispersion Modelling

9.6.82 Following the CCGT stack height determination study, a full dispersion modelling exercise was undertaken. This used a CCGT stack height of 75 m and the meteorological data from Southend Airport for the years 2004 to 2008 inclusive.

9.6.83 The predicted concentrations from the detailed dispersion modelling are considered to be the likely worst case as base load operation is assumed. In reality GEC may actually run at various loading regimes, including cycling.

9.6.84 In the case of annual average concentrations, these are calculated on the basis of GEC operating for 93 per cent of the year at full load. This is considered to be an upper parameter scenario, as GEC will require outage periods for routine annual maintenance that will as a minimum require c. 1 per cent down time throughout the year. In addition it is possible that the plant would often operate at loads of down to 70 per cent in order to ‘ramp up’ when the National Grid requires an increase in supply, such as when the wind ceases to blow sufficiently hard for wind turbines to generate.

9.6.85 The overall effect of running GEC at various loading regimes other than base load on predicted concentrations of NO_2 will be to lower the long term average. This is due to the fact that GEC is operating less. In addition, there is also the potential to lower the maximum predicted short term averages as GEC may not operate during the meteorological conditions which lead to peak concentrations.

9.6.86 Modelling of the auxiliary boiler plant has not been undertaken in conjunction with the operation of the CCGT as it is likely that this plant will likely only operate when the CCGT is out of service.

Modelling Results

9.6.87 A conservative view of the operation of GEC has been adopted in the modelling so that a likely "worst case" is presented. The purpose of using this approach is to ensure that the upper parameter of predicted impacts within the potential operating regime of GEC is considered. This ensures that there is a "factor of safety" built into the air quality assessment. The results of the modelling have been compared to NAQS objectives.

9.6.88 Table 9.15 presents the likely worse case maximum annual average ground level concentrations of NO_2 predicted by the detailed dispersion modelling of GEC considered in isolation. The Table also shows the relevant NAQS Objectives and reports the distance and direction from GEC of the maximum predicted concentration. The Table indicates the meteorological data year for which the maximum was observed.

9.6.89 Isopleths have been prepared to show the increments for the maximum 19th highest hourly average concentration of NO_2 and the maximum annual average ground level concentration of NO_2 for the 4 km by 4 km and 20 km by 20 km study grids. These are presented as Figures 9.3 to 9.6 respectively in Volume 3.

TABLE 9.15: MAXIMUM ANNUAL AVERAGE GROUND LEVEL CONCENTRATIONS OF NO_2 DUE TO GEC (µg/m^3)

Averaging Period	*Increment to Ground Level Concentrations*	*Guideline*	*Distance (km)*	*Direction (°)*	*Year*
Annual Average	0.3	40	1.2	60	2007
19th Highest Hourly Average	12.0	200	1.2	55	2007

9.6.90 The predictions above are compared with the NSCA Significance Criteria (presented in Table 9.1 and Table 9.2) in Table 9.16 below.

TABLE 9.16: SIGNIFICANCE OF MAXIMUM GROUND LEVEL CONCENTRATIONS

Averaging Period	*Increment to Ground Level Concentrations*	*NETCEN Background**	*Total Concentration*	*Increment as % of Guideline*	*Total Concentration as % of Guideline*	*Significance as per Table 9.2*
CCGT Plant						
Annual Average	0.3	19.0	19.3	0.8	48.3	Negligible
19th Highest Hourly Average	12.0	38.0	50.0	6.0	25.0	Negligible
Boiler Plant* **						
19th Highest Hourly Average	49.0	38.0	87.0	24.5	43.5	Negligible
**The NETCEN background value for 2015 has been adopted for the grid square in which the maximum ground level concentration is predicted **In accordance with best practice, the annual average background concentration has been doubled for assessment against short term predictions ***Note boiler plant will likely only operate when CCGT units are unavailable therefore no annual figure is provided.*						

Analysis of Results

9.6.91 The results of the modelling have been compared to appropriate objectives. Key findings from the assessment are:

- GEC will not give rise to high ground level concentrations of NO_2.
- The predicted maximum increase in long-term (annual average) ground level NO_2 concentrations due to the operation of GEC CCGT units is 0.3 µg/m^3. This is well within the long-term NAQS objective of 40 µg/m^3. The maximum long-term ground level NO_2 concentration occurs at a point just over 1.2 km to the north east of the GEC site.
- The predicted maximum increase in short-term (19th highest hourly average) ground level NO_2 concentrations due to the operation of GEC CCGT units is 12.0 µg/m^3. This is approximately 6 per cent of the short-term NAQS objective of 200 µg/m^3. The maximum short-term ground level NO_2 concentration occurs at a point just over 1.2 km to the north east of the GEC site.
- In addition, operation of GEC will not significantly increase ground level NO_2 concentrations at the various monitoring locations and AQMA in the area.
- As such, when considered along with the existing ground level concentrations in the surrounding area, it is not considered that GEC will give rise to any additional exceedences of any of the relevant NAQS objectives.

9.6.92 It is important to consider the findings of the modelling assessment with the existing ambient air quality recorded in the vicinity of GEC. However, it should be noted that the contribution from GEC to ground level concentrations of pollutants cannot simply be added to those for the existing sources in the area, since in many instances the locations and prevailing weather conditions of the two maximums may be different.

9.6.93 With regard to the occurrence of long term maxima from various sources, the likelihood of them coinciding is high. This is due to the long averaging periods and the variation in meteorological conditions over the averaging period.

9.6.94 As such, when the various annual average background concentrations in the area of GEC are considered in addition to those predicted by the modelling, it can clearly be seen that GEC will have a negligible effect on air quality and should not lead to any additional exceedences of the NAQS objectives.

9.6.95 Using the NETCEN 2015 predictions for NO_2 concentrations it can be predicted that, in the likely worst case scenario, GEC will increase maximum average ground level concentrations of NO_2 from 19.0 μg/m^3 to 19.3 μg/m^3. This means that the likely worst case maximum annual ground level NO_2 concentration should not come close to the 40 μg/m^3 objective of the NAQS.

9.6.96 For short term averaging periods, there is less likely to be such a coincidence of contributions from several sources. This is due to the weather conditions associated with the maximum from each source type. Plumes from point sources, such as power station or boiler plumes, generally provide a maximum increment to ground level concentrations when the weather conditions are warm and / or windy. Conversely the maximums associated with line sources, i.e. roads, occur when it is calm, cold and there is a low level inversion. During these times the thermally buoyant plume from a point source will burst through the inversion layer and disperse over a larger area. The inversion layer will severely limit the ability of the plume to reach the ground once the plume is above it.

9.6.97 GEC maximum short term concentrations will be a small percentage of the NAQS objective and will occur at times when contributions from other sources are low. Thus there will be no risk of generating any exceedance of the short term objective and affecting whether the short term objective is achieved.

9.6.98 Additionally, although unlikely as highlighted above, even if the likely worst case contribution predicted for GEC is added to the likely worst case recorded 19th highest hourly average of 130 μg/m^3 recorded at Stanford-le-Hope automatic monitoring station the resulting concentration of 142.0 μg/m^3 would not even come close to exceeding the NAQS objective of 200 μg/m^3 for CCGT. It should also be noted that even when the more elevated (but more localised) predictions for the boiler plant are considered the level would not be exceeded.

9.6.99 The location of maximum increments is indicative of the prevailing meteorological conditions, i.e. predominantly south westerly winds. In practice, the predicted small increments to annual average levels due to GEC would be virtually undetectable using diffusion tubes or other monitoring equipment in use today.

9.6.100 Therefore, the emissions from GEC during operation will not lead to an exceedance of the NAQS objectives. It can therefore be concluded that GEC will not have a significant impact on air quality with regard to short or long term ground level concentrations of NO_2.

9.7 Mitigation Measures and Monitoring Programmes

Construction

9.7.1 Good site management practices during the construction works will help to prevent the generation of airborne dust. GECL will require its construction contractors to take sufficient precautionary measures to limit dust generation.

9.7.2 To ensure that atmospheric dust, contaminants or dust deposits generated by the construction do not exceed levels which could constitute a health hazard or nuisance to those persons working on the GEC site or living nearby, a dust monitoring programme will be carried out throughout the construction period as part of the Construction Environmental Management Plan. Details of this are provided in Section 5. If the potential for dust emissions exists, for example on dry windy days, then the following procedures or similar will be followed where appropriate:

- Materials will be assessed for moisture content;
- If material is dry then water will be sprayed on to the working area to suppress dust;
- Excavation faces not being worked will, if required, be either sheeted or treated with a suitable dust suppressant; and
- All operatives working in areas of potential dust emission will be provided with paper type face masks.

9.7.3 In addition, the following measures or similar will be implemented where appropriate:

- Materials deposited on stockpiles on the GEC site will be closely monitored for any possible emission of dust and if required they will be damped down, covered or treated with a suitable dust suppressant;
- If finely ground materials are delivered, it may be required that these are in bag form or stockpiled in specified locations where the material can be suitably covered;
- All vehicles carrying bulk materials into or out of the GEC site should be covered to prevent dust emission, and minimum drop heights will be used during material transfer;
- Potential dust emissions from moving construction plant and site transport will be mitigated by the use of water bowsers, which will dampen all movement areas being utilized by traffic;
- Wheel washing facility will be provided, if necessary, adjacent to the GEC site exit which will be used by all heavy commercial vehicles leaving the GEC site, preventing the transmission of soil from the GEC site to the public highway; and,
- Also a road sweeping vehicle will be employed when required during the construction period to remove dust and dirt from all the public roads.

9.7.4 It should be noted that the above measures may only be necessary should the activities leading to the greatest dust generation occur during a dry period. As such, if care is taken during construction, dust emissions will not impact on local air quality.

Operation

9.7.5 The following mitigating measures have been included in the design of GEC:

- The use of DLN Combustion Technology, which ensures NO_x levels will be in accordance with LCPD requirements;
- The use of a fuel inherently low in sulphur; and
- A stack of sufficient height and flue gases of sufficient temperature and velocity to ensure good dispersion.

9.7.6 In combination, the above measures will result in limited increases in background concentrations of NO_x, negligible emissions of particulates and negligible emissions of SO_2, such that no further measures are deemed necessary.

9.7.7 Emissions will be controlled during operation in accordance with the manufacturer's recommendations and the limits and conditions specified in the Environmental Permit for the process, taking account of the technical guidance available for this type of plant.

9.7.8 The stacks will be fitted with a continuous NO_x and CO monitor. The measured value will be recorded and displayed in the Control Room. Routine calibration checks will be carried out as recommended by the manufacturer and as agreed with the EA. Any other ad-hoc calibration checks required by the EA will be carried out. An oxygen monitor will also be supplied and results from this will be used to correct the NO_x measured value to the format required by the EA. Either a moisture meter will be provided or a mathematical correction factor based on combustion of natural gas will be used to convert to the dry condition. The results from this stack monitoring will be available to the public in the Public Register held by the EA.

9.7.9 Sampling points and safe access adjacent to the continuous monitoring points will be installed.

9.7.10 Regular observation of stack air emissions will also be made.

9.8 Assessment of Residual Effects

Construction

9.8.1 Dust emissions from the GEC site will not be more onerous than those normally encountered on construction sites. GECL will require its contractors to implement a comprehensive mitigation and monitoring programme to prevent construction work generating levels of atmospheric dust that would constitute a health hazard or nuisance to people working on the GEC site or living nearby.

9.8.2 Dust is unlikely to result in any significant environmental impact during the construction phase.

Operation

Section 9.6 presented predictions and estimates of the maximum GEC process contribution to ground level concentrations of nitrogen dioxide. These were assessed against the background levels, and no significant impacts were predicted from the GEC emissions to air. The mitigation detailed in Section 9.7 is incorporated into the plant design to ensure that the pollutant emissions concentrations to not exceed those assumed as part of the air dispersion modelling study.

9.9 Assessment of Cumulative and Indirect Effects

9.9.1 The only major new development in the area which is likely to contribute to cumulative air quality impacts, which is not already included in the existing baseline, is the LG Development. Extensive work and surveys for the LG Development has already been undertaken for the separate consent applications which have already been made as detailed previously.

9.9.2 The potential air quality impacts identified for the LG Development are mainly those arising from dust emissions during construction (similar to those described above for the construction of GEC) and from vehicle emissions during operations due to the nature of the LG Business and Logistics Park.

9.9.3 As reported in the ES for the LG Development with mitigation in place, any potential air quality emissions are not likely to significantly affect air quality in the surrounding area. As a result cumulative impacts in this regard will be negligible.

9.9.4 With regard to any new gas, CHP and electricity lines associated with the proposed GEC for the proposed plant impacts would be similar to those encountered during the construction phase of the power station albeit the duration would be significantly shorter with works likely to be completed over the course of about a year.

9.9.5 There would be some potential for dust creation however this would be controlled through the sorts of mitigation measures outlined in Section 9.7.

SECTION 10

NOISE AND VIBRATION

10 NOISE AND VIBRATION

10.1 Summary

10.1.1 An assessment of the noise impact of GEC, and the subsequent likelihood of complaints, has been completed in accordance with procedures outlined in BS 4142:1997 “Method of Rating Industrial Noise Affecting Mixed Residential and Industrial Areas”.

10.1.2 The residential positions chosen for the evaluation have been identified and measurements have been made of background noise levels during the most sensitive night-time period. The nearest residential and sensitive area is Oozedam Farm, approximately 1 km to the north east of the GEC site.

10.1.3 The gas turbines and steam turbine equipment are the most significant operational sources of noise generation associated with the proposed GEC. The gas turbines will be contained within acoustic enclosures in order to attenuate the noise. It is envisaged that the area of the building containing the steam turbine equipment will be acoustically treated.

10.1.4 The level of noise control that will be provided at GEC is based on achieving the appropriate limits or better. This will result in there being no significant noise impact due to the construction or operation of GEC. There will be no impact due to operational vibration with some minimal vibration associated with piling during construction.

10.1.5 In the interest of maintaining neighbouring relations and residential amenity, GECL will give a reasonable period of notice to the Local Authority and residents prior to any planned non-normal operations that would lead to an increase in noise levels. Where necessary, these would be carried out between 09:00 and 17:00 hours during weekdays wherever possible.

10.1.6 With suitable noise attenuation it is envisaged that GEC will not lead to a perceptible increase in noise at the NSR, and as such, during construction and operation, the impact of noise is not predicted to be significant. This is due to both the distances between the GEC site and the Noise Sensitive Receptor (NSR) locations (during construction and operation) and the temporary and changing nature of the noise source (mainly during construction).

10.2 Introduction

10.2.1 This Section presents the noise and vibration impact assessment, and includes:

- The assessment methodology and significance criteria adopted in undertaking the assessment;
- The baseline conditions on which the impact of GEC is assessed (presented in the Baseline Noise Survey in Volume 2 Appendix C);
- The potential (pre-mitigation) significant environmental impacts which GEC may have;
- The mitigation measures to be adopted; and,
- The resultant residual (post-mitigation) significant impacts of the construction and operation of GEC.

10.2.2 Cumulative residual impacts are also considered within this Section.

10.3 Key Planning Policies

10.3.1 Section 3 provides the planning policy content. The policies listed below have informed the assessment process, to which reference has been made in Section 3. A full transcript of these policies is contained in Volume 2 Appendix A.

East of England Plan

ENV7	Quality in the Built Environment

10.4 Assessment Methodology and Significance Criteria

Assessment Methodology

10.4.1 The following impact assessment focuses on six NSR locations, which are identified below. Existing baseline conditions at each location are determined by way of an attended Baseline Noise Survey.

10.4.2 A prediction of the impact during construction is undertaken following the methodology of BS 5228, and information regarding the noise output of specific items of plant contained therein. The noise and vibration impacts during operation are predicted using a noise propagation model, using typical values for the proposed plant items, and considering directional and screening effects. The significance of the predicted impact is assessed against the semantics of BS 4142.

10.4.3 This Section also recommends mitigation options to control construction and operational impacts.

Relevant Guidance

10.4.4 The following guidance is used for the assessment:

- BS 4142:1997 ‘Method for Rating Industrial Noise affecting Mixed Residential and Industrial Areas’, BSI
- BS 7445: 1991 'Description and Measurement of Environmental Noise' Parts 1 to 3, BSI
- BS 5228: 1997 'Noise and Vibration Control on Construction and Open Sites' Parts 1 to 4, BSI

10.4.5 BS 4142 ‘Method for Rating Industrial Noise affecting Mixed Residential and Industrial Areas’ offers guidance on the assessment of industrial and commercial noise affecting residential and industrial areas. It describes a method for assessing whether industrial noise is likely to result in complaints from nearby residents.

10.4.6 BS7445 'Description and Measurement of Environmental Noise' defines and prescribes best practice during recording and reporting of environmental noise. It is inherently applied in all instances when making environmental noise measurements.

10.4.7 BS 5228 'Noise and vibration control on construction and open sites' gives recommendations for basic methods of noise and vibration control relating to construction sites and other open sites where construction activities are carried out. It offers a methodology for predicting noise levels from construction sites.

Significance Criteria

10.4.8 The significance criteria for the construction and operational phases of GEC are provided below.

10.4.9 Table 10.1 sets out the construction noise significance threshold taken from BS 5228:2009 for day, night, evening and weekend periods.

TABLE 10.1: CONSTRUCTION NOISE SIGNIFICANCE THRESHOLD

Period	***Period Classification***	***Threshold Level ($L_{Aeq,T}$)***
Night-time	23:00 – 07:00	45
Evening & Weekends	19:00 – 23:00 Weekdays 13:00 – 23:00 Saturdays 07:00 – 23:00 Sundays.	55
Daytime	07:00 – 19:00 07:00 – 13:00 Saturdays	65

10.4.10 In addition BS 4142 provides a methodology for the assessment of industrial noise in mixed residential and industrial areas. In this case, the standard suggests obtaining an assessment level by comparing the existing background noise levels with the 'Rating Level', which is the predicted noise output of the proposed plant, corrected to account for any acoustic features such as tonal or impulsive noises. The semantics used for assessing the likelihood of complaints due to the introduction of a new industrial noise source are as follows:

- When subtracting the background level from the rating level, the greater the difference, the greater the likelihood of complaints.
- A difference of around +10 dB or more indicates that complaints are likely.
- A difference of around +5 dB is of marginal significance.
- If the rating level is more than 10 dB below the measured background noise level then this is a positive indication that complaints are unlikely.

10.4.11 The assessment methodology and significance criteria detailed above is applicable to the assessment of operational noise from GEC, and the cumulative operational noise from GEC and the LG Development.

10.5 Baseline Conditions and Receptors

Noise Sensitive Receptors

10.5.1 A number of residential Noise Sensitive Receptors (NSR's) exist around the proposed GEC site. These include the those detailed in Table 10.2.

TABLE 10.2: SUMMARY OF NOISE SURVEY MEASUREMENT POSITIONS

NSR Location Number	**NSR Location**	**Monitoring Location Coordinates**		**Approx Distance From Centre of Site (m)**
		X	**Y**	
1	Corner of Billet Lane and Rainbow Lane	569601.68	182396.85	3587
2	Oak Farm, High road	570197.13	182606.92	3034
3	Corringham Primary School, Herd Lane	571184.02	183516.41	2514
4	End of Wharf Road, Corringham	571945.47	183792.01	2195
5	Start of track leading up to Oozedam Farm, The Manorway	573835.77	182782.81	1059
6	New residential development, Haven Road, Canvey island	577300.22	182242.58	4147

10.5.2 Figure 10.1 shows these locations in relation to the GEC site.

Baseline Conditions

10.5.3 Baseline conditions were determined by way of an assessment to obtain existing noise levels at each NSR location. All monitoring was conducted using Class 1 Sound Level Meters. A field calibrator was used to calibrate and check the meter before and after the measurement period with no change in level recorded.

10.5.4 The Baseline Noise Report is provided in Appendix C. Specific details of the equipment used, including serial numbers and calibration dates is provided in the Annex of this report.

10.5.5 In accordance with the standards (above), the measurement microphones were positioned 1.4 m above ground level, well away from vertical reflective facades. Weather conditions were conducive to successful monitoring, with zero precipitation and wind speeds of less than 5 m/s. A wind-shield was used to minimise the effects of wind noise.

10.5.6 Baseline noise measurements were taken at each of the NSR positions identified above. Measurements took place on a typical weekday between and inclusive of the 27^{th} and 28^{th} of January 2010. Weather conditions were conducive to successful monitoring; with wind speeds less than $5ms^{-1}$. Roads were dry, and there was no precipitation at the time of measurement. The ambient temperature was between 5°C and 10°C during the monitoring period. Each measurement recorded the same five statistical parameters (L_{90}, L_{eq}, L_{max}, L_{10}, L_{min}.) in unweighted third octave bands, with the overall figure reported using the A-weighed frequency network.

10.5.7 Access onto NSR5, Oozedam Farm was not available during the baseline noise survey. As such, a measurement was undertaken at the nearest point available, which was at the entrance to the access road of Oozedam Farm. Using this measurement and extrapolation of additional background data measured in the area a representative background noise level been calculated at Oozedam Farm.

10.5.8 The full results of the baseline noise measurements are presented in the noise survey report provided in Appendix C. Table 10.3 summarises the lowest L_{A90} recorded at each NSR position.

TABLE 10.3: SUMMARY OF LOWEST RECORDED L_{A90} AT EACH MEASUREMENT POSITION

NSR Number	Measurement Position	Lowest Day Time Recorded L_{A90} (dB(A))	Lowest Night Time Recorded L_{A90} (dB(A))
NSR 1	Corner of Billet Lane and Rainbow Lane	44	41
NSR 2	Oak Farm, High road	45	37
NSR 3	Corringham Primary School, Herd Lane	45	37
NSR 4	End of Wharf Road, Corringham	38	31
NSR 5	Oozedam Farm, The Manorway*	54	38
NSR 6	New residential development, Haven Road, Canvey island	43	38

**Calculated background noise level as access to site was not available.*

10.6 Potential Impacts

Construction

<u>Construction Noise</u>

10.6.1 Construction activity inevitably leads to some degree of noise disturbance at locations in close proximity to the construction activities. It is however a temporary source of noise. The noise levels generated by construction activities would have the potential to impact upon nearby NSR. Noise levels at any one location will vary as different combinations of plant machinery are used, and throughout the construction of the proposed plant as the construction activities and locations within the site change.

10.6.2 The likely construction noise levels have been predicted using the methodology set out in BS 5228:2009 in conjunction with general information regarding proposed activities. These are presented in Table 10.4

TABLE 10.4: SOUND LEVEL DATA FOR TYPICAL CONSTRUCTION PLANT & ACTIVITIES

Construction Activity / Associated Plant	Calculated Sound Pressure Level, dB(A)						
	10m from plant	NSR 1	NSR 2	NSR 3	NSR 4	NSR 5	NSR 6
Site Preparation							
Dozer	24	25	27	28	35	23	24
Tracked Excavator	27	28	30	31	38	26	27
Wheeled Backhoe Loader	17	18	20	21	28	16	17
Excavation							
Dozer	30	31	33	34	41	29	30
Tracked Excavator	28	29	31	32	39	27	28
Loading Lorry	29	30	32	33	40	28	29
Articulated Dump Truck	30	31	33	34	41	29	30
Rolling and Compaction							
Roller	28	29	31	32	39	27	28
Vibratory Plate	29	30	32	33	40	28	29
Piling							
Hydraulic Hammer Rig	38	39	41	42	49	37	38
Rotary Bored Piling Rig	32	33	35	36	43	31	32
Welding/Cutting Steel							
Welder (Welding Piles)	22	23	25	26	33	21	22
Generator for welder	6	7	9	10	17	5	6
Cutter (Cutting Piles)	17	18	20	21	28	16	17
Other							
Lge Lorry Concrete Mixer	26	27	29	30	37	25	26
Conc. Pump (Discharging)	16	17	19	20	27	15	16
Tower Crane	26	27	29	30	37	25	26
Total	93	42	43	45	46	52	40

10.6.3 Table 10.4 shows the predicted noise levels at each NSR location associated with typical construction activities. The estimated sound pressure levels shown are worst-case estimates based on distance attenuation only, and do not consider any screening, directivity or absorptive effects.

10.6.4 Construction activities are not anticipated to occur during the night time, as such construction noise has been assessed against the lowest measured daytime L_{A90}. The predicted cumulative construction noise level is predicted to exceed the lowest measured daytime L_{A90} at one location, NSR 4. This exceedance is below the specified limit, as identified in Table 10.1 and is not considered significant.

10.6.5 Predicted construction noise at all NSR's is below the daytime limit of 65 dB(A), and the evening and weekend limit of 55 dB(A).

10.6.6 Considering the temporary and changing nature of the proposed construction works, the overall impact of construction noise is not predicted to be significant.

10.6.7 GECL will require its appointed contractor to minimise the impact of construction activities through successful implementation of an agreed Construction Environmental Management Plan (CEMP) and proper communication with local residents.

Construction Vibration

10.6.8 Some construction activities can be a source of ground-borne vibration, which can impact the nearest receptors. Typical activities that would lead to vibration effects include compaction, breaking and piling.

10.6.9 Vibration from construction activities may impact on adjacent buildings. The principal concern is generally transient vibration due to piling. Cosmetic damage is most likely to occur to within the first 20 m of piling activities; damage is less likely to occur at greater distance. The peak particle velocity (PPV) limits considered to create cosmetic damage to buildings generally begin at around 50 mms^{-1}

10.6.10 The impact at the nearest properties from any vibration activities is a function of the vibration source and the propagation path to the receptor; larger distances reduce the impact. PPV vibration from piling activities at the nearest NSR; Oozedam Farm has been calculated with the following results.

TABLE 10.5: CONSTRUCTION VIBRATION

NSR Distance (m)	Resultant PPV (mms^{-1})
1053	0.2

10.6.11 Table 10.5 shows vibration impacts specific to GEC piling activities will be negligible, hence vibration due to piling activity is not assessed further in this study.

Operation

Operational Noise

10.6.12 The computer noise modelling software CadnaA Version 3.7 has been used to undertake the noise calculations. The model estimates the contribution to noise levels at each NSR location, of each major identified plant noise source, based on typical sound power levels for the type of plant proposed.

10.6.13 The model is intended to provide a worst-case assessment of the noise level likely to be experienced at each NSR location. A number of assumptions are made with regards to the noise control likely to be installed on major plant items, and these are stated below.

10.6.14 The following assumptions with regards to noise control have been made:

- Gas turbines are to be housed in individual acoustic enclosures, of heavy construction, specified at 85 dB(A) Sound Pressure Level at 1 m. In turn, these and are subsequently housed within the Turbine Hall, resulting in the modelled sound pressure level.
- Gas turbine filter and ventilation apertures are to be fitted with silencers.
- Air Cooled Condensers designed with appropriate noise mitigating features will be used.
- Due to the impracticality of screening stack noise, discharge noise will be controlled using engineered silencers tuned to attenuate low frequencies from the gas turbine exhausts.
- Typical noise levels for the unit transformers and generator transformers have been included.
- All plant items shall be controlled to minimise noise of an impulsive or tonal nature, such that the rating level as defined in BS 4142 is equal to the specific noise level.
- The model considers normal operational noise. As such, noise due to other non-normal operation plant items have not been considered.

10.6.15 Appendix C shows the Noise Source Data / Sound Power Levels used for the calculations whilst Figure 10.1 the predicted spread of noise levels surrounding the proposed development.

10.6.16 Based on PB's experience with CCGT Projects in the UK, we have not identified any perceptible tonality at the distances involved in the assessment and as such no acoustic feature corrections need to be applied to the levels predicted.

10.6.17 Table 10.6 summarises the predicted noise levels (constant A-weighted Sound Pressure Level, L_A) from the proposed plant only, at each of the six NSR locations. The measured background noise levels (L_{A90}) are also shown and compared to the BS4142 rating level.

TABLE 10.6: BS4142 ASSESSMENT TABLE

NSR Location No.	**1**	**2**	**3**	**4**	**5**	**6**
Predicted Plant Noise Level, L_{Aeq}	21	23	25	26	31	19
Rating Penalty, dB	0	0	0	0	0	0
Rating Level, dB(A)	21	23	25	26	31	19
Lowest Night Background Level, L_{A90}	41	37	37	31	38	38
Difference	-20	-14	-12	-5	-7	-19

10.6.18 At all locations the Rating Level is below the existing background level. According to the semantics of BS 4142, noise at NSR locations 4 and 5 will be of less than marginal significance.

10.6.19 Further to this, noise levels at all other identified NSR's are more than 10 dB below the existing background level, this gives a positive indication that complaints are unlikely.

10.6.20 It is considered unlikely that noise levels from site operations would be audible at any identified NSR locations. Therefore, the impact of operational noise at all NSR locations is predicted to be not significant.

Operational Vibration

10.6.21 It is predicted that on site vibration sources will include the following:

- Balanced rotating equipment, such as turbines; and
- Wind induced vibrations in the stacks and condenser structures, to be transmitted to the foundations.

10.6.22 As all rotating machinery is to be located on substantial foundations, any transmitted vibration into the ground will be minimal, and there are no structures whose design would result in undue wind induced vibration. It is not therefore anticipated that the level of induced vibration will be sufficient to propagate to the nearest sensitive receptors over the distances involved. Hence the impact of operational vibration is not assessed further.

10.7 Mitigation

Construction

10.7.1 In order to keep noise impacts from the construction phase to a minimum, all construction activities would be carried out in accordance with the recommendations of BS 5228. In addition, the following mitigation measures would be implemented through the Construction Environmental Management Plan (CEMP):

- Initially and until the buildings are closed and capable of providing an 'indoor working environment', construction work will only take place during Monday to Saturdays 07:00 – 19:00 hours. No work on any Sunday or Bank Holidays will be undertaken, unless such work is associated with an emergency or does not cause existing ambient noise levels to be exceeded at nearby Noise Sensitive Receptors (NSR). Should a need arise, due to technical constraints or similar, with regard to carrying out certain construction work outside the time indicated above, prior written approval from Thurrock Borough Council (TBC) (as the relevant Health Authority) will be sought.
- To the extent required by the local authority, specific method statements and risk assessments would be produced for night working. In order to minimise the likelihood of noise complaints in such eventualities, the contractor would inform and agree the works in advance with the Environmental Health Officer (EHO), informing affected residents of the works to be carried out outside normal hours. Furthermore, the residents would be provided with a point of contact for any queries or complaints.
- All vehicles and mechanical plant used for construction will be fitted with customary exhaust silencers, and regularly maintained.
- Plant construction equipment will be used where appropriate. All major compressors would be sound-reduced models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers.
- All ancillary plant construction equipment such as generators, compressors and pumps will be positioned so as to cause minimum noise disturbance. If necessary, temporary acoustic barriers or enclosures would be provided.

Operation

10.7.2 Planning noise limits will be agreed with the Local Authority at the consent stage, and GECL will take all measures required to assure compliance with these planning noise limits.

10.7.3 The following measures would serve to continually monitor and minimise the impact of noise from the GEC:

- A computer model of the proposed plant items will be produced at the detailed design stage, to calculate the predicted noise levels at the NSR locations, and ensure that planning limits are adhered to. Detailed design will ensure that site noise is mitigated as far as possible, through site layout and orientation of noisy plant items.
- Since tonal or impulsive noises are considered more annoying than continuous noise sources, plant items will be silenced or otherwise controlled through regular maintenance to ensure no such emissions are audible at NSR locations.
- A noise survey shortly following the commissioning of the new plant, shall be agreed with the Local Authority. The aim of this survey shall be to ensure that plant noise levels as measured at the agreed NSR locations do not exceed the planning noise limits agreed with the local authority. Noise monitoring shall be undertaken in accordance with BS 4142.
- In the event of a complaint by a local resident relating to noise levels during the operation of the Development, an investigation shall be carried out by the operator, or a representative thereof, to determine the likely cause of the complaint, and if necessary any available remedial measures. Where it is deemed necessary by the Local Authority, a written report detailing these measures and their effectiveness will be provided.
- In addition to the noise control measures mentioned above, silencers will be fitted to achieve noise attenuation on plant including gas turbine and HRSG inlets and ductwork. Acoustic lagging and low noise trims will be fitted to specific pipe-work and noise generating steam valves where required.
- Acoustic enclosures will be considered, and provided where required, for all plant items where practicable, including for smaller plant items such as compressors and pumps.
- Where required, internal surfaces within the turbine hall should be treated to control internal reverberant noise levels. An appropriate treatment would consist of dense mineral wool panel behind perforated sheet steel, or a spray on cellulose fibre treatment.
- In the interest of maintaining neighbourly relations and residential amenity, the company will give a reasonable period of notice to residents and the local authority prior to any planned non-normal operations that would lead to an increase in noise levels. These planned events will be carried out between 0900 and 1700 hours during the weekdays, wherever possible.
- Although 'normally-off' plant items have not been included in the modelling of normal plant operation, these will be afforded the same level of noise control as all other plant as appropriate.

10.8 Assessment of Residual Effects

Construction

10.8.1 Section 10.6 presented predictions and estimates of noise from the various construction phases for GEC. These were assessed against the background levels, and no significant impacts from construction noise were predicted. However, the mitigation detailed in Section 10.7 is aimed to ensure that any noise produced during construction does not exceed these predictions.

Operation

10.8.2 The calculation and assessment of operational noise in Section 10.6 is based on a number of assumptions about the forms of mitigation, which the proposed Development will incorporate. These forms of mitigation are detailed in Section 10.7. With mitigation measures in place no residual impacts are predicted.

10.9 Assessment of Cumulative Effects

10.9.1 The new development in the area likely to have potential cumulative impacts when considered with GEC is the LG Development, which has recently started construction.

10.9.2 Noise prediction work was undertaken to support the consent applications for the LG Development, and as such noise levels were predicted at a number of NSR that were also considered in this assessment.

10.9.3 A comparison is provided in the Table 10.7.

TABLE 10.7: COMPARISON WITH PREDICTED NOISE FROM LONDON GATEWAY ES

NSR	NSR Description	Predicted Rating Noise Level due to GEC dB(A)	Rating Noise Level from London Gateway ES dB(A)	Screening Correction	Difference	Combined Level
1	Corner of Billet Lane and Rainbow Lane	21	35	10	24	35
2	Oak Farm, High road	23	40	10	27	40
3	Corringham Primary School, Herd Lane	25	31	10	16	31
4	End of Wharf Road, Corringham	26	31	10	15	31
5	Oozedam Farm, The Manorway*	31	-*	-	-	-
6	New residential development, Haven Road, Canvey island	19	-*	-	-	-

**Measurement and assessment was not undertaken at these locations for the LG Development Consent applications*

10.9.4 As Table 10.7 demonstrates, noise levels from the GEC at all NSR's are greater than 10 dB below the predicted operational noise level of the LG Development.

10.9.5 As such, cumulative noise increase due to the simultaneous operation of GEC and the LG Development is not expected.

SECTION 11

LANDSCAPE AND VISUAL

11 LANDSCAPE AND VISUAL

11.1 Summary

11.1.1 A landscape and visual impact assessment (LVIA) has been undertaken for GEC. This has included the preparation of photomontages, based on a design concept, from which an impression can be ascertained as to the likely scale and visual impact of GEC.

11.1.2 The photomontages represent the views from 10 viewpoints which have been identified as being representative of the likely visual impact which would be encountered in the area.

11.1.3 The substantial buildings envisaged on site are the turbine hall, heat recovery steam generators (HRSG), Air Cooled Condensers (ACCs) and storage tanks. The remaining plant and equipment will predominately be housed in relatively low buildings of the order of 5 to 10 m in height. The tallest structures on site will be the two 75 m stacks.

11.1.4 The GEC will be the subject of further design which will be used to determine it's ultimate appearance once constructed. This is detailed further in the Design and Access Statement which accompanies the consent application.

11.1.5 The LVIA study found that the development of GEC would not have unacceptable impacts to the local landscape, which is already dominated by existing industrial developments, in particular the much larger Coryton Oil Refinery, Shell storage tanks and, to a lesser extent, the existing CECL Power Station.

11.2 Introduction

11.2.1 This Section presents the LVIA for GEC. This has included consideration of the impacts to visual receptors and well as the landscape character of the area.

11.3 Key Planning Policies

11.3.1 Section 3 provides the planning policy content. The policies listed below have informed the assessment process, to which reference has been made in Section 3. A full transcript of these policies is contained in Volume 2 Appendix A.

East of England Plan

SS7	Green Belt
SS8	The Urban Fringe
SS9	The Coast
ENV1	Green Infrastructure
ENV2	Landscape Conservation
ENV7	Quality in the Built Environment
ETG1	Strategy for the Sub-Region

Thurrock Borough Local Plan

BE1	Design of New Development
BE4	Landscaping
GB1	The Green Belt in Thurrock
GB2	Design Considerations in the Green Belt
LN2	Landscape Improvement Areas
LN3	Landscapes of Local Importance

11.4 Assessment Methodology and Significance Criteria

Assessment Methodology

11.4.1 The assessment is based on revised guidance set out in 'Landscape and Visual Impact Assessment' published by the Landscape Institute and Institute for Environmental Assessment (2002).

11.4.2 The first stage of the assessment involves establishing the landscape and visual baseline of the proposed development site and the surrounding area.

11.4.3 The second stage of the assessment process initially involves the identification of landscape and visual impacts associated with the proposed development.

11.4.4 Landscape and visual impacts or effects can be direct or indirect, positive or negative and permanent or temporary. The identification of impacts clearly distinguishes between those impacts upon the physical landscape resource and those associated with visual amenity and views across the site. Impacts are also considered in terms of whether they are permanent (normally associated with the operation phase) or temporary (normally associated with the construction phase).

Significance Criteria

11.4.5 The Guidelines for Landscape and Visual Impact Assessment state (Paragraph 7.42):

"*No [quantitative] formal guidance exists for the assessment of significance for landscape and visual effects and the assessor must clearly define the criteria used in the assessment for each project, using his or her skill based on professional judgement*."

Assessing Landscape Impacts

11.4.6 Landscape impacts are defined by the Landscape Institute as "*changes to landscape elements, characteristics, character and qualities of the landscape as a result of development*".

11.4.7 The potential landscape impacts occurring during the construction and operation period may therefore include, but are not restricted to, the following:

- *Landscape Elements*
  In addition to consideration of the elements which determine the landscape character, this takes into account the addition of new elements to the landscape or the removal of existing elements, such as trees, vegetation and buildings.
- *Landscape Characteristics and Character*
  This considers the effects of the development through the incremental effect on the characteristic landscape elements and the magnitude of the effects which would be sufficient to alter the overall landscape character type of the area.
- *Landscape Qualities*
  This considers the magnitude of the degradation / erosion of landscape elements and patterns, particularly those which form the characteristic elements of landscape character types.

11.4.8 The above potential impacts are also considered in terms of cumulative landscape impacts, where more than one project may lead to a potential landscape impact.

<u>Landscape Sensitivity and Magnitude of Change</u>

11.4.9 Landscape effects are assessed using a combination of factors. These include:

- The sensitivity of the landscape; and
- The scale / magnitude of effects.

11.4.10 The sensitivity of the landscape is described in Table 11.1, and provides an indication of the degree to which change from the development can be accommodated. This takes into account aspects such as: land use (the function of the landscape); the pattern / diversity and scale of the landscape; its openness; the value of the landscape resource including areas designated for such value; and, scope for mitigation.

11.4.11 The sensitivity of the landscape to a particular development is determined through reference to the baseline assessment of the existing landscape resource. Sensitivity is assessed by taking into account the existing landscape resource and its quality, value and capacity.

11.4.12 The main factors to be considered are as follows:

- *Landscape Quality:*
  The state of repair or condition of elements of the landscape which determine its integrity and intactness considered alongside the extent to which its distinctive character is apparent. The quality of a landscape element or characteristic may also be influenced by the degree to which it may contribute to the overall landscape character. This will include consideration of its rarity and the potential for its replacement or mitigation. Landscapes of lower quality tend to include those under intensive agriculture or urban fringe situations such that the landscape elements and patterns have been eroded, almost creating a new and different landscape character. In these areas, the landscape management objectives may be focused on landscape repair, restoration, and enhancement.
- *Landscape Value:*
  The importance attached to a landscape (often as a basis for designation or recognition) which expresses international, national or local consensus. This may be due factors such as its cultural associations, scenic or aesthetic characteristics. In most cases, landscape value is indicated by the presence or absence of a landscape planning designation such as An Area of Outstanding Natural Beauty; National Park; or, Area of High Landscape Value.
- *Landscape Capacity:*
  The capacity of a particular type / area of landscape to accommodate the proposed development without unacceptable effects on its character.

11.4.13 It should be noted that a landscape of high or great value may not always equate to areas of high or great landscape quality (particularly if they are designated for other landscape and visual reasons). Similarly areas of low landscape value may contain areas of higher landscape quality.

11.4.14 Sensitivity of the landscape is classified as high, medium or low.

TABLE 11.1: CRITERIA FOR THE ASSESSMENT OF LANDSCAPE SENSITIVITY

Sensitivity	***Criteria***	***Scale***	***Examples***
High	*Landscapes that are:* Highly valued / Particularly rare or distinctive / Susceptible to small changes	International National	World Heritage Site / National Park / Area of Outstanding Natural Beauty
Lower landscape capacity and *high landscape sensitivity*			
Moderate	*Landscapes that are:* Valued more locally / Tolerant of moderate levels of change	Regional Local	Area of High Landscape Value (AHLV) / Undesignated but value expressed in (for instance) demonstrable use

Sensitivity	*Criteria*	*Scale*	*Examples*
Moderate landscape capacity and *moderate landscape sensitivity*			
Low	*Landscapes that are:* More commonplace / Potentially tolerant of noticeable change Undergoing substantial development such that their character is one of change	Local	Undesignated
Higher landscape capacity and *low landscape sensitivity*			

11.4.15 The scale / magnitude of effects is described in Table 11.2, and considers the degree of change to the landscape.

11.4.16 The magnitude, or degree of change, considers the scale and extent of proposed change. This may include the loss or addition of particular features, and changes to landscape quality and character.

11.4.17 Much like sensitivity of the landscape, magnitude is defined as high, medium, low or negligible.

11.4.18 Table 11.2 is used as a general guide as to how magnitude is classified.

TABLE 11.2: CRITERIA FOR THE ASSESSMENT OF MAGNITUDE OF CHANGE

Level	*Criteria*
High	A noticeable change to the landscape over a wide area or an intensive change over a limited area
Medium	Minor changes to the landscape over a wide area or noticeable change over a limited area
Low	Very minor changes to the landscape over a wide area or minor changes over a limited area
Negligible	No or minimal perceptible changes to the landscape

Evaluating Landscape Impacts

11.4.19 The significance of effects is then assessed as a combination of sensitivity and magnitude of change. This is a process assisted by the use of Table 11.3 which may be used to guide the assessment.

TABLE 11.3: SIGNIFICANCE OF LANDSCAPE IMPACT

		Magnitude of Change			
		High	***Medium***	***Low***	***Negligible / None***
Landscape Sensitivity	***High***	Major	Major / Moderate	Moderate	Moderate / Minor
	Medium	Major / Moderate	Moderate	Moderate / Minor	Minor
	Low	Moderate	Moderate / Minor	Minor	Minor / None

Key: [shaded] Significant; [unshaded] Not Significant

11.4.20 The thresholds detailed in Table 11.3, based on a combination of the sensitivity of the landscape and the magnitude of the change, are then used to determine significance of the landscape impacts.

TABLE 11.4: DESCRIPTION OF SIGNFICANCE OF LANDSCAPE IMPACT

Significance	***Definition Guideline***	***Threshold***
Major	A fundamental change to the environment	Noticeable change to a highly sensitive or nationally valued landscape, or intensive change to less sensitive or regionally valued landscape
Moderate	A material but non-fundamental change to the environment	Noticeable change to a landscape tolerant of moderate levels of change, or minor change to a highly sensitive or nationally valued landscape
Minor	A detectable but non-material change to the environment	Minor changes to a landscape considered tolerant of change
None	No detectable change to the environment	No discernible change to the landscape

11.4.21 The type and probability of effect are also considered and included at the end of the assessment. These are discussed as per the terms defined below:

- *Temporary / Permanent*
  The time period over which an impact may occur is referred to as ‘temporary’ (used to define shorter time scales mainly those associated with construction) or ‘permanent’ (used to define longer time scales mainly those associated with operation).
- *Direct / Indirect Effects*
  Used to define whether the development would result in direct impacts via a direct loss of features contributing to the landscape character or resource, or would result in indirect impacts, which are not a direct result of the development, but are often produced away from it or as a result of a complex pathway.
- *Positive / Negative*
  The effects may be positive (beneficial), neutral or negative (adverse). In the

case of an industrial development it is likely that the most noticeable effects and changes will be those due to landscape and visual impacts. However, the assessment guidelines do not allow for an automatic assumption that all impacts would be negative.

- Cumulative Effects:
  Effects may also be cumulative as the development may be viewed in conjunction with other existing, consented or proposed developments in the area.

11.4.22 Mitigation measures are considered where there is scope for undertaking works that will assist in preventing, reducing or offsetting any adverse effects of the development.

11.4.23 Overall, the main element of mitigation incorporated into the scheme to prevent, reduce or offset any adverse effects has been the careful siting of the proposed plant and associated infrastructure.

Assessing Visual Impacts

11.4.24 Visual impacts are recognised by the Landscape Institute as a subset of landscape effects which are concerned wholly with the effect of the development on views and the general visual amenity.

11.4.25 The visual effects are identified for different receptors (people) who will experience the view at either: their places of residence; during recreational activities; at work; or, when travelling through the area.

11.4.26 The visual effects may include the following:

- *Visual Effect*
  This is caused by a change to an existing view, views or wider visual amenity as a result of the development in isolation or the loss of particular landscape elements or features already present in the view due to the development in isolation.
- *Cumulative Visual Effects*
  These are caused by the cumulative or incremental visibility of similar types of developments which may combine to have a cumulative visual effect represented by the following scenarios:
  - *Combined or Simultaneously Visibility*
    Where the observer is able to see two or more developments from a single fixed viewpoint either in combination (where projects are within the observer's arc of vision at the same time) or in succession (where the observer has to turn to see the various developments)
  - *Sequential Effects on Visibility*
    Where the observer has to move to another viewpoint to see other developments or a different view of the same development (e.g. when travelling along a route)

11.4.27 Within this impact assessment the visual impacts are assessed from a number of viewpoints.

<u>Viewpoint Assessment</u>

11.4.28 A viewpoint assessment has been undertaken for the visual impact assessment and is conducted from selected viewpoints within the study area. The purpose of this is to assess both the level of visual impact for particular receptors and to help guide the assessment of the overall effect on visual amenity and landscape character.

11.4.29 Figure 11.1 provides a zone of theoretical visibility (ZTV) diagram demonstrating the areas from which GEC might be visible for a variety of stack heights. Figure 11.2 provides a ZTV diagram for a stack height of 75m.

11.4.30 Based on the information from Figure 11.2 a total of 10 viewpoints were selected.

11.4.31 The viewpoints were chosen based on the following criteria:

- Viewpoints should be representative of the likely impacts;
- Viewpoints should show a range of different types of views;
- Viewpoints should be representative of a range of different receptor groups;
- Viewpoints should be representative of a range of distances; and
- Viewpoints should be representative of the varying image of GEC in the landscape.

11.4.32 Figure 11.3 shows the location of the viewpoints selected. In each case the direction of view from the viewpoint is that towards the proposed stacks. The selected viewpoints are representative of locations from which views of GEC can be experienced. These are located at different distances and directions from the GEC site and include settlements, publicly accessible roads and footpaths.

11.4.33 Detailed analysis of the viewpoints includes a description of the existing and predicted view and analysis of the magnitude of change.

11.4.34 The aim of the viewpoints assessment is to identify, predict and evaluate potential effects arising from the development of GEC.

11.4.35 The visual sensitivity and magnitude of change is then used in combination to assess the significance of the landscape and visual effects. The significance of the landscape and visual effects will be quantified and interpreted by professional judgement on pre-defined criteria to provide consistency within the assessment. These are detailed below.

Visual Sensitivity and Magnitude of Change

11.4.36 Similar to assessing the landscape effects, the visual effects are assessed using a combination of factors. These include:

- The sensitivity of the visual receptor; and
- The scale / magnitude of effects.

11.4.37 The sensitivity of the visual receptors is described in Table 11.5. This takes into account the various factors affecting visual sensitivity including: the location and context of the viewpoint (in terms of the landscape value, landscape quality and landscape capacity); the activity of the receptors; the importance / popularity of the view; and, the typical numbers of viewers.

TABLE 11.5: CRITERIA FOR THE ASSESSMENT OF VISUAL RECEPTOR SENSITIVITY

Sensitivity	***Criteria***	***Scale***	***Examples***
High	*Views from:* Highly valued landscapes;/ Residential properties / Long distance or strategic recreational	International National	World Heritage Site National Park Areas of Outstanding Natural Beauty National Nature Reserves

Sensitivity	*Criteria*	*Scale*	*Examples*
	footpaths / Important recreational landscape features, beauty spots and picnic areas		
Medium	*Views from:* Valued areas of landscape / Local and less well used footpaths or tracks / *Receptors include:* Walkers, cyclists, horse riders, road users and rail passengers	Regional Local	Area of High Landscape Value (AHLV) Areas of Great Landscape Value (AGLV) Landscapes of County Importance (LCI) Locally Important Landscapes Undesignated but value expressed in (for instance) demonstrable use
Low	*Views from:* Landscapes of lower value with low footpath or recreational use / Non-designated farmland or moorland / Commercial property / Outdoor recreation areas (e.g. playing fields) *Receptors include:* People at their place of work or taking part in activities not involving appreciation of the landscape.	Local	Undesignated

11.4.38 The scale / magnitude of effects is described in Table 11.6, and considers the degree of change caused by GEC which may affect the view.

11.4.39 The magnitude of visual change is described by reference to the following factors:

- *The scale of change in the view*
  This includes the extent and proportion of the field of view affected which is considered to be approximately 90°. The scale of change in the view takes into consideration the loss or addition of features in the view and changes in the composition and extent of view affected.
- *The degree of contrast or integration of the development in the view*
  This includes consideration of the degree of contrast or integration of any new

features or changes due to the development within the existing or remaining landscape, and the characteristics in terms of mass, scale, colour and texture.

- *The proximity and distance from the development and the speed at which the development may be viewed from a particular viewpoint.*
- *The angle of the view of the development from the main direction of view*
  This includes consideration the elevation and openness of the view, and whether the development would be viewed against the skyline or a background landscape.
- *The duration of the change*
  For example whether the view would be temporary or long term, intermittent or continuous. This takes into account seasonal changes, such as periodic management and leaf fall.

TABLE 11.6: CRITERIA FOR THE ASSESSMENT OF MAGNITUDE OF CHANGE

Level	***Criteria***
High	A major change or obstruction of an existing view, with the development being directly visible and appearing as a dominant feature in the foreground.
Medium	A moderate change or partial view of a new element within the existing view that may be readily noticed, with the development being directly or obliquely visible (including glimpsed, partly screened or intermittent views) such that it appears a prominent feature in the middle ground.
Low	A low level of change to the existing view, with the possibility that the development may be obliquely viewed or partly screened such that it appears as a visible feature in the background landscape. This may include the development being viewed when moving at speed.
Negligible	A small or intermittent change to the existing view, with the possibility that the development may be obliquely viewed and mostly screened such that it appears as a minor element in the distant background. This may include the development being viewed at high speed over short periods and capable of being missed by the casual observer.

<u>Evaluating Visual Effects</u>

11.4.40 The significance of effects is then assessed as a combination of sensitivity and magnitude of change. This is a process assisted by the use of Table 11.7 which may be used to guide the assessment.

TABLE 11.7: SIGNIFICANCE OF VISUAL IMPACTS

		Magnitude of Change			
		High	***Medium***	***Low***	***Negligible / None***
Landscape Sensitivity	***High***	Major	Major / Moderate	Moderate	Moderate / Minor
	Medium	Major / Moderate	Moderate	Moderate / Minor	Minor
	Low	Moderate	Moderate / Minor	Minor	Minor / None

Key: Significant (shaded) | Not Significant (unshaded)

11.4.41 The thresholds detailed in Table 11.7, based on a combination of the sensitivity of the landscape and the magnitude of the change, are then used to determine significance of the visual impacts.

TABLE 11.8: DESCRIPTION OF SIGNIFICANCE OF VISUAL IMPACTS

Significance	***Criteria***
Major	A substantial deterioration or improvement to the existing view or situation
Moderate	A moderate deterioration or improvement to the existing view or situation
Minor	A small deterioration or improvement to the existing view or situation
None	No change

11.4.42 As before, the type and probability of effect are also considered and included at the end of the assessment. These are discussed as per the terms defined below:

- *Temporary / Permanent*
  The time period over which an impact may occur is referred to as 'temporary' (used to define shorter time scales mainly those associated with construction) or 'permanent' (used to define longer time scales mainly those associated with operation).
- *Direct / Indirect Effects*
  Used to define whether the development would result in direct impacts via a direct loss of features contributing to the landscape character or resource, or would result in indirect impacts, which are not a direct result of the development, but are often produced away from it or as a result of a complex pathway.
- *Positive / Negative*
  The effects may be positive (beneficial), neutral or negative (adverse). In the case of an industrial development it is likely that the most noticeable effects and changes will be those due to landscape and visual impacts. However, the assessment guidelines do not allow for an automatic assumption that all impacts would be negative.
- *Cumulative Effects:*
  Effects may also be cumulative as the development may be viewed in conjunction with other existing, consented or proposed developments in the area.

11.4.43 In visual terms, positive and negative effects are less easy to define or quantify as they require subjective consideration of a number of aesthetic factors affecting the view.

11.4.44 Whilst, generally opinions as to the visual effects of industry are negative / adverse, this assessment will seek to consider factors such as the visual composition of the landscape both with and without the development to establish whether the development may be reasonably accommodated within the scale and character of the landscape when perceived from the viewpoint locations.

11.5 Baseline Conditions and Receptors

11.5.1 Whilst the application site boundary for GEC incorporates areas to the north and west which may be used for temporary laydown during construction, overall approximately 29.1 hectares (71.9 acres), once constructed the GEC site will be approximately 11.3 hectares (28.0 acres) in size (including CCR land).

11.5.2 The GEC site is situated on the north bank of the Thames Estuary and lies approximately 6 km east of the A13. The A1014 dual carriageway (The Manorway) lies to the north of the site and runs east to west to provide a link with the A13, which in turn links in with the M25 at Junction 30.

11.5.3 To the east of the GEC site lies the existing Coryton CCGT Power Station (700 m east), which began operating in 2002 and is run by Coryton Energy Ltd (CECL). Further east lies the existing Coryton Oil Refinery (950 m).

11.5.4 Land immediately surrounding the north / west of the GEC site (but within the northern border of the LG Development) largely consists of grazing marshland interspersed by a network of reed-fringed drainage ditches and creeks.

Landscape Baselines

Sites of Special Scientific Interest (SSSI)

11.5.5 There are a number of SSSI in the vicinity of the site but none closer than 1 km. These are detailed in Section 12, Ecology and include the SSSI at “Pitsea Marsh”(4 km, north), “Mucking Flats and Marshes”(2.5 km, south west), “Vange and Fobbing Marshes”(1.5 km, north), “Holehaven Creek”(2 km, north east), and, “South Thames Estuary and Marshes”(2 km, south).

Ramsar Sites, Special Protection Area (SPA) and Special Areas of Conservation (SAC)

11.5.6 There are two Ramsar Sites surrounding the site, these are the Thames Estuary and Marshes (2 km, south) and Benfleet and Southend Marshes (6.5 km, north east). These sites are also SPA’s. There are no SAC’s within 10 km of the GEC site.

World Heritage Sites, Areas of Outstanding Natural Beauty and National Parks

11.5.7 There are no World Heritage Sites, Areas of Outstanding Natural Beauty and National Parks within 10 km of the site.

Special Landscape Area

11.5.8 The North Kent Marshes are notified as a Special Landscape Area by Kent County Council for the following reasons:

“*The North Kent Marshes have a special and unusual character which is rare in a country, if not in a national context. Their wild and remote character is accentuated by the contrast with the busy Thames estuary, extensive areas of urban development nearby, and an industrial backdrop to the horizon. The area itself is largely underdeveloped and the marshes are of international wildlife interest*”.

Areas of Local Landscape Importance

11.5.9 The Thurrock District Local Plan includes a number of landscape designations including Areas of Local Landscape Importance in which the GEC site is not located. The nearest is the estuary at Hole Haven approximately 1 km to the north east.

Scheduled Monuments and Listed Buildings

The location of Scheduled Monuments and Listed Buildings are discussed in Section 16 Cultural Heritage which includes details of their designation also.

11.5.10 There are three Scheduled Monuments within a 5 km radius of the site but none on the site itself. These include the “World War II Bombing Decoy on Fobbing Marshes” (1.7 km, north), the “Heavy Anti-aircraft Gunsite” 3.3 km, north east), and the “Roman Saltern” (5 km, north east).

11.5.11 Table 16.4 provides details of the Listed Buildings in the area. Just one of these, Church of St Michael, some 2.5 km to the north-west, is listed for its historical setting with all other Listed Buildings being listed for their architectural type. The closest of these is Walnut Tree Cottages located some 2 km to the north-west of the site.

Public Rights of Way

11.5.12 There are no rights of way within the site boundary. The nearest footpath to the site is some 500 m to the north east linking with the A1014 with a number of other rights of way within the first few km of the site. These can be seen on the OS map in Figure 1.1. Another footpath in the south runs along the bank of the River Thames which has good views of the north bank and the GEC site.

Transport Routes

11.5.13 The A1014 is the only major road within 2 km of the GEC site and runs east west connecting Stamford-le-Hope and the A13 to the Coryton Refinery. Views from this location are constrained to some degree by planting along the road side and will in the future be further constrained by the buildings and landscaping associated with the LG development. Views from the road are dominated by the refinery and heavy industry that borders the eastern side of the GEC site.

Landscape Character

11.5.14 Landscape character is what makes an area unique.

11.5.15 Natural England define it as "*a distinct, recognisable and consistent pattern of elements, be it natural (soil, landform) and/or human (for example settlement and development) in the landscape that makes one landscape different from another, rather than better or worse. By understanding how places differ Natural England can ensure that future development in an area is well situated, sensitive to its location, and contributes to environmental, social and economic objectives for the area”*.

National Context

11.5.16 The GEC site is located within the Greater Thames Estuary Character Area (as identified by Natural England’s Joint Character Areas) and is close to the Northern Thames Basin Character Area.

11.5.17 Key characteristics of the Greater Thames Estuary Joint Character Area include:

- *Extensive open spaces dominated by the sky within a predominantly flat, low-lying landscape. The pervasive presence of water and numerous coastal estuaries extend the maritime influence far inland.*
- *Pressure on edges, particularly around major estuaries, from urban, industrial and recreational developments together with the associated infrastructure requirements often on highly visible sites against which the marshes are often viewed.*
- *The Thames edge marshes are themselves subject to the chaotic activity of various major developments including ports, waste disposal, marine dredging, urbanisation, mineral extraction and prominent power stations plus numerous other industry-related activities such as petrochemical complexes*.

11.5.18 Key characteristics of the Northern Thames Basin Joint Character Area include:

- *A diverse landscape with a series of broad valleys containing the major rivers Ver, Colne and Lea and extensive areas of broadleaved woodlands being the principal features of the area. The landform is varied with a wide plateau divided by the valleys.*
- *Hertfordshire’s large towns, the M25 and M1 motorways, railway line and prominent electricity pylons are also a major influence on character.*
- *Floodplain land is commonly arable sub-divided by hedgerow-deficient field boundaries. Open grazing land remains in certain areas.*
- *Many river valleys have been extensively modified by reservoirs, current and reclaimed gravel pits, landfill sites, artificial wetlands, river realignments and canals.*
- *Smaller, intimate tree-lined valleys supporting red brick villages provide a contrast to the more heavily developed major river valley floodplains. Within these river valleys, organic field shapes are common, defined by water courses and the legacy of woodland clearances rather than formal enclosure patterns.*

- *Broader plateau areas are mainly in agricultural use, with field patterns exhibiting the regular shape characteristic of 18th century enclosures.*

11.5.19 National Landscape Character Areas are shown in Figure 11.4.

Local Context

11.5.20 The GEC site lies within the Northern Thames Marshes (Industrial Marsh) Local Landscape Character Area (LLCA). Immediately to the south of the area lies the River Thames LLCA with the Eastern Thames Marshes LLCA to the south of the River.

11.5.21 Key characteristics of the Northern Thames Marshes LLCA include:

- *A large area of alluvial marshland between the River Thames at its southern boundary, and the rising land to the west and north. It includes Fobbing, Vange, Bowers and Hadleigh marshes.*
- *The common characteristics which unite these marshes are their predominantly flat, open, low-lying landscapes dominated by the sky, which gives a strong feeling of remoteness, and allows extensive views both into and out of the area. However, localised variation in landform and land use make this landscape quite fragmented.*

11.5.22 The GEC site lies within the Industrial Marsh Sub-Character Area of the Northern Thames Marshes LLCA. Key characteristics of this sub-character area include:

- *Areas of major industrial or port development are a prominent feature of this sub-character area and provide contrasting dramatic vertical features in a landscape context which otherwise has a strong horizontal emphasis. The plant, buildings and equipment comprise a variety of large circular tanks ranging in height between 13 and 27m tall, arranged in clustered grids with road links between them, and a complex of refinery pipes and chimneys up to 112m tall.*
- *The former Shellhaven refinery is also serviced by an existing single-track railway (The Tilbury Branch Line) which links from the Thames Haven Junction and divides into a series of sidings within the south of the refinery site. This rail link has scrub vegetation along most of its length which visually contains it.*

11.5.23 Key characteristics of the River Thames LLCA include:

- *An extensive, open, exposed stretch of water, edged along much of its length by a bunded sea wall. Isolated area of salt marsh are evident at dispersed locations along the edge, as are creeks and shingle beaches which contrast with the dominant edge of the sea wall.*
- *Mucking flats to the North and Blyth Sands to the south are important features. A feature of the northern shoreline is the jetties, which protrude into the estuary and dominate the sea frontage giving an industrial character to the Estuaries edge. Large container vessels, ferries and other ocean going vessels pass regularly through the Estuary and contribute to the character of the area by adding movement and drama to the river corridor. This landscape has medium to high quality and high sensitivity.*

11.5.24 Key characteristics of the Eastern Thames Marshes LLCA include:

- *This character area comprises a large area of alluvial marshland between the River Thames at its northern boundary and the rising land associated with the Hoo Peninsula to the south. Its distinctive characteristics are a flat, low-lying landscape dominated by the sky, which gives a strong feeling of remoteness and isolation, and allows extensive views both into and out of the area.*
- *There are, however, variations in land use which, together with urban or industrial development, have had an influence on the more natural qualities of the marshes.*

11.5.25 Local Landscape Character Areas are shown in Figure 11.5.

Visual Baseline

Views from the North

11.5.26 The land to the north of the Site is within the Northern Thames Marshes. Views of the LG Development site are generally broad and open due to the flat and relatively un-vegetated nature of the marshes. However, views are often seen in the context of the developed river edge, in particular the Coryton Oil Refinery and the visible overhead power lines.

11.5.27 Views are the most significant from Fobbing Marshes where extensive views are possible, especially from footpaths closest to the site. Elevated landforms of Wat Tyler Country Park and the waste disposal site help to screen the site from Viewpoints in Vange Marshes and Bowers Marshes, and views are often seen in the context of the Coryton Oil Refinery.

11.5.28 Further to the north, views of the former Shellhaven Oil Refinery are restricted to a number of elevated and open vantage points, such as One Tree Hill (60 m AOD) and Westley Heights (105 m AOD). From here there are dramatic panoramic views of the site, seen within the broad context of the estuary.

11.5.29 There are also distant views of the site from Pitsea Ridge, however these are also seen in the broad context of the Thames Estuary and through visual detractors such as power lines and pylons, the landfill tip and the Coryton Oil Refinery.

Views from the West

11.5.30 There are extensive, elevated views of the storage tanks and chimney structures along the Thames Estuary from the residential edges of Corringham and Stanford-le-Hope, and these views continue down to the edge of Fobbing Marsh. They are especially significant where the hedgerow vegetation, characteristic of the area, and which would otherwise restrict views of the site, is either lost or fragmented.

11.5.31 From the fields between Stanford Industrial Estate and the edge of Stanford, views are limited to the tallest on-site chimney structures visible above the crest of the landform. Views from Fobbing and its east facing slopes are substantially screened due to the intervening landform, vegetation and settlements, especially around Fobbing itself.

11.5.32 Further to the west, there are wide and expansive views from elevated ground, such as the golf course near Stanford-le-Hope, Hordon on the Hill, and from the area between Corringham and Langdon. From lower lying areas, the site is screened by intervening vegetation and the rooflines of the buildings

11.5.33 From the south west, clear and closer views are possible between East Tilbury and Coalhouse, however views are often screened by vegetation.

Views from the South

11.5.34 Due to the open, flat nature of the River Thames, views of the site are extensive and the structures of the former refinery dominate the character or the northern shoreline. The former Shellhaven Oil Refinery forms a backdrop to views from the Eastern Thames Marshes, although these are distant and in the areas closer to the bunded sea wall allow views only of the taller chimneys. Naturally regenerating vegetation around Cliffe Lagoons, west of Cliffe help to filter and screen views around this area.

11.5.35 Further to the south, the visibility of the former Shellhaven Oil Refinery structures is closely related to land use. Views are generally restricted due to vegetation and therefore the site is well screened. The wooded nature of the Hoo Peninsula prominent Hills means that intervening vegetation screens views of the former refinery. However, due to its elevated landform there are a number of vantage points at the edges of the woodland, and from more open hilltops.

Views from the East

11.5.36 Land to the east is dominated by the Coryton Oil Refinery. Views of the site from Hadleigh Marshes are either well screened or insignificant due to the distance from the site and the wider landscape context. Views are evident from South Benfleet and from limited elevation and open vantage points, such as Hadleigh Castle. These views are from at least 6 km away and are seen within a broader landscape context which includes other industrial development and visual detractors remote from the site.

Potential Visual Receptors

11.5.37 Figure 11.2 provides a Zone of Theoretical Visual Influence (ZTV) diagram for the 10 km surrounding GEC site based on visibility of the 75 m stack. The ZTV diagram uses terrain data from Ordnance Survey to predict the land area from which a plant item would be visible. The size of the zone will always be overstated as the model does not take into account the screening effect of local features such as buildings, trees and hedgerows.

11.5.38 Figure 11.2 shows that, in theory, the GEC site will be visible from the greater proportion of the surrounding area.

11.5.39 The model used to generate the ZTV uses terrain data at 10 m resolution to calculate the theoretical ZTV and does not take into account existing structures and objects, such as buildings and trees / vegetation. Therefore the image presented in Figure 11.2 presents a worst case scenario that might not ultimately be reflected in reality.

Illustrative Viewpoints

11.5.40 For the purpose of this assessment, 10 viewpoints have been selected in order to illustrate the typical visual impact of GEC site when viewed from the surrounding area. These viewpoints are described in Table 11.9. The locations of the viewpoints in relation to the GEC are shown in Figure 11.3.

11.5.41 Photographs and photomontages showing both the existing view and the anticipated view incorporating the GEC are set out in Figure 11.6 to Figure 11.15.

TABLE 11.9: LOCATIONS OF ILLUSTRATIVE VIEWPOINTS

Viewpoint		*Distance from Site (km)*	*Nature of Receptor (e.g. residential, recreational etc)*	*Sensitivity*
1	Oozedam Country Road	1.3 (N)	This view was selected to represent views for the country road over the Oozedam. Also of footpath users.	Medium
2	Road Bridge on the Canvey Way (A130)	4.8 (NE)	The view was selected to represent the views from the Hope Green residential area.	Medium
3	Hadleigh Castle	8.6 (NEE)	This view was selected to represent the views from the Hadleigh Castle Country Park and Marsh	Medium
4	Swigshole	7.0 (SEE)	This view was selected to represent the views from the marshland on the south of the river	Medium
5	Northward Hill (Corner of Cooling Road and Wybournes Lane)	8.0 (SE)	The view was selected to represent the views from the Northward Hill Nature Reserve and High Halstow	High
6	Cooling	6.4 (SSE)	The view was selected to represent the views from Cooling	High
7	Cliffe Marshes Northern border with Thames	2.5 (S)	The view was selected to represent the views from the Cliffe Marshes	Medium
8	East Tilbury – Coalhouse Fort	6.5 (SW)	The view was selected to represent the views from the residential areas of east Tilbury	High
9	Oak Farm	3.2 (NWW)	The view was selected to represent the views from residential areas on the south east of Corrington	High
10	Wat Tyler Country Park	3.9 (N)	This view was selected to represent views for the country road over the Oozedam. Also of users of the Country Park.	High

Viewpoint 1

11.5.42 The photograph shown in Figure 11.6 shows the view from the farm field just off Oozedam Country Road, approximately 1.3 km north of the GEC site across a field looking south towards the site.

11.5.43 The viewpoint is crossed left to right by the transmission lines suspended by two transmission towers to the left and centre of the picture. In the centre of the photograph it is possible to see silos of the oil refinery and to the far left the ACC of the pre-existing CECL CCGT.

Viewpoint 2

11.5.44 The photograph shown in Figure 11.7 shows the view from the Road Bridge on the Canvey Way (A130), approximately 4.8 km north-east of the GEC site across a number of fields looking south west towards the site.

11.5.45 The oil refinery stacks and silos can be easily identified in the centre of the photograph whilst a number of transmission towers can be seen on the horizon.

Viewpoint 3

11.5.46 The photograph shown in Figure 11.8 shows the view from Hadleigh Castle, approximately 8.6 km north-east of the GEC site looking south-west towards the site.

11.5.47 In this left side photograph it is possible to view Canvey Island. Hadleigh Castle is currently a tourist attraction and used by the local community as a recreational area. The oil refinery adjacent to the GEC site can easily be identified from the tall stacks and the white silos from this viewpoint.

Viewpoint 4

11.5.48 The photograph shown in Figure 11.9 shows the view from the farm road near to Wigshole, proximately 7.0 km south-east of the GEC site across numerous fields and marshland looking north-west towards the site.

11.5.49 The oil refinery stacks and silos can easily be identified in the centre of the photograph.

Viewpoint 5

11.5.50 The photograph shown in Figure 11.10 shows the view from High Halstow at the corner of Cooling Road and Wybournes Lane, approximately 8.0 km south-east of the GEC site looking across open fields.

11.5.51 The viewpoint is elevated, looking out over the southern site of the River Thames and represents views from the village High Halstow. The site can easily be identified from the tall stacks and white silos of the Coryton Oil Refinery in the centre of the photograph.

Viewpoint 6

11.5.52 The photograph shown in Figure 11.11 shows the view from Cooling, approximately 6.4 km south of the GEC site looking north towards the site.

11.5.53 In the centre of the photograph it is possible to see silos and stacks of the oil refinery adjacent to the GEC site.

Viewpoint 7

11.5.54 The photograph shown in Figure 11.12 shows the view from Cliffe Marshes northern border with Thames, approximately 2.5 km south of the GEC. This location is located on immediately opposing bank of the River Thames from the GEC site.

11.5.55 The GEC site is located to the left of the white silos in the centre of the photograph. Towards the right hand side of the photograph it is possible to see the oil refinery. It is also possible to see the transmission lines and towers on the northern side of the river running left to right across the horizon.

Viewpoint 8

11.5.56 The photograph shown in Figure 11.13 shows the view from Coalhouse Fort near East Tilbury, approximately 6.5 km south-west of the GEC site across marshland looking north-east towards the site.

11.5.57 The photograph location is at the tourist attraction of Coalhouse Fort. The viewpoint looks out over the Mucking marshes in a north east direction where the stacks and silos of the oil refinery can again be identified in the centre of the photograph.

Viewpoint 9

11.5.58 The photograph shown in Figure 11.14 shows the view from Oak Farm near Corringham, approximately 3.2 km west of the GEC site.

11.5.59 The oil refinery can be identified in the centre of the photograph and there are several transmission line crossing the view.

Viewpoint 10

11.5.60 The photograph shown in Figure 11.15 shows the view from Wat Tyler Country Park approximately 3.9 km north of the GEC site.

11.5.61 The photograph was taken from the Wat Tyler Country Park. The viewpoint is crossed left to right by the transmission lines suspended by two transmission towers to the left and centre of the picture. In the centre of the photograph it is possible to see silos of the oil refinery and to the far left the ACC of the existing CECL Power Station.

11.6 Potential Impacts

Construction

11.6.1 Throughout construction, the GEC site will have the appearance of a typical construction site.

11.6.2 As such, the principal landscape and visual impacts associated with the construction phases will be those associated with the:

- Temporary site compounds, including temporary lighting, fencing and temporary buildings and structures;
- Storage of materials (lay down areas) and other plant and machinery;
- Site clearance, including land associated with the proposed GEC plant and other temporary site compounds; and
- Temporary plant, such as cranes and vehicle movements, associated with site construction.

Operation

11.6.3 The potential landscape and visual impacts during operation are mainly those associated with structure and operation of the proposed plant. These have been previously described in detail in Section 4 of this ES.

11.6.4 The proposed development site will result in the loss of approximately 11.3 ha of land. The proposed layout of GEC is shown in Figure 4.1 (single-shaft) and Figure 4.2 (multi-shaft).

11.6.5 The substantial buildings envisaged on site are the Turbine Hall, HRSGs and air cooled condensers. The remaining plant and equipment will predominately be housed in relatively low buildings, of the order of 5 to 10 m in height. The tallest structures on site will be the 75 m high stacks.

11.6.6 The indicative details of the GEC site are likely to be as shown within Table 11.10. These are shown on the parameter block model layout in Figure 4.3.

TABLE 11.10: ESTIMATED MAIN STRUCTURE / PLANT ITEM DIMENSIONS

Structure / Plant Item Include	*Height (Up To) (m)*	*Area (m^2)*
Gas Receiving Facility (Orange Area) • Gas Receiving Facility	14	6 080
Water Storage Tanks (Brown Area) • Demineralised Water Storage Tank • Raw / Firewater Tank • Water Treatment Plant	23	11 600
Administration Block (Pink Area) • Warehouse, Maintenance, Admin and Control Building • Car Parking	17	6 870
Main CCGT Plant (Blue Area) • Gas Turbine Area • Heat Recovery Steam Generator • Steam Turbine Area • Transformers • Air Cooled Condensers	42	41 600
CCS Area / Temporary Laydown (Green Area)	-	47 100
Stacks (Black striped Area within the Blue Area)	75	Within Main CCGT Plant

11.6.7 The buildings and overall plant will be of a modern and functional design and will be industrial in character and appearance. The structure will have a relatively simple clear outline, with the use of cladding and materials with finishes in recessive colours to help reduce visual impacts. Further details are provided in the Design and Access Statement which accompanies the consent application.

11.6.8 The main impacts associated with the operation of the GEC will be:

- Permanent daytime visual impacts associated with GEC, which will introduce new, industrial plant to the locality;
- Permanent night time visual impacts associated with lighting for GEC;
- New perimeter fencing and internal access roads;
- Change of land use; and
- Loss of existing landscape features associated with the GEC site.

Assessment of Landscape Impacts

11.6.9 This sub-section examines the significance of landscape impacts arising from the development of GEC.

11.6.10 As described previously, the significance of the landscape impacts due to a development may be considered to reflect the extent to which the proposal is compatible with the character and perceived quality of the local landscape. A range of factors including the scale of the local landform, the pattern of landscape features and general sensitivity of the landscape in relation to the scale and layout of the proposed plant will influence the degree of compatibility.

11.6.11 The assessment considers the potential effects of the proposal on:

- The Landscape Quality including the Landscape Fabric / elements of the site itself as well as the site surroundings;
- The Landscape Value, reflecting the importance of the landscape with regard to Landscape Designations within the study area; and
- The Landscape Capacity which is a means by judging the potential for a development to be incorporated in the landscape which is defined at least in part by the Landscape Character

11.6.12 Accordingly the assessment considers the baseline characteristics of each landscape type / designated area, the extent of predicted visibility, magnitude of change and the effect of the development on landscape character.

Impacts on the surrounding Landscape

Landscape Sensitivity

11.6.13 It is considered, given the above that the area, particularly around the GEC site is less sensitive to industrial use and can be assumed to have a low sensitivity to landscape changes. The landscape already includes a significant level of industrial infrastructure as discussed in Section 5. In the future the GEC will occupy land within the much wider business complex that will make up the LG Development. The construction of the LG Development will eventually further characterise the area as being a industrial in nature.

Magnitude of Change

11.6.14 The proposal would essentially introduce two 42 m high HRSG's each with a 75 m stack and associated items of plant to the landscape that would be visible over some areas of the surrounding terrain (in the worst case those identified by the ZTV).

11.6.15 Changes to landscape fabric occur only within the application boundary of a site where there would be direct and indirect physical change to the landscape. There would be a permanent change to the site itself through the further levelling of the site. During the construction phase there will be other temporary effects on the landscape fabric of the site as the result of ground disturbance.

11.6.16 During the operational life of the development there will be long term but ultimately reversible effects on the landscape fabric of the site which is in any case part of a much larger industrial park.

11.6.17 The magnitude of change to the landscape character would be *medium* as the field studies have found that only minor changes to the landscape over a wide area are likely to be observed albeit that more a noticeable change will definitely be experienced over a limited area.

Impact

11.6.18 Given the above discussion and the use of the tables at the start of this section which discuss significance criteria it can be concluded that the impact to landscape character would be '*Moderate'* and therefore not significant.

Assessment of Visual Impacts

Viewpoint 1

11.6.19 The photomontage shown in Figure 11.6 shows the predicted view from the farm field just off Oozedam Country Road, approximately 1.3 km north of the GEC site across a field looking south towards the site.

11.6.20 The proposed power station can be seen behind the transmission lines and tanks in the foreground of the picture. The plant is for the most part obscured such that views are significantly restricted from this location.

Receptor Sensitivity

11.6.21 The receptor is considered to have a 'medium' sensitivity given its recreational nature as a footpath albeit that the views are dominated by the transmission pylons in the foreground and the oil refinery to the east of the GEC site.

Magnitude of Change

11.6.22 The magnitude of change to the existing view would be 'Low' as the views of the plant are limited and views are already dominated by the existing industrial infrastructure.

Impact

11.6.23 It can be concluded, that the impact to the receptor would be *Moderate/Minor* and *not significant*.

Viewpoint 2

11.6.24 The photomontage shown in Figure 11.7 shows the predicted view from the Road Bridge on the Canvey Way (A130), approximately 4.8 km north east of the GEC site across numerous fields looking south west towards the site.

The GEC plant is almost entirely obscured from this location by the wider industrial plant to the east of the site however the stack and some higher items of plant can still be seen.

Receptor Sensitivity

11.6.25 The receptor is considered to have a 'Low' sensitivity given the lack of nearby properties, recreational areas and other more sensitive receptors. The view is typical of the impact of the plant as viewed from the A130 running north from Canvey Island to North Benfleet.

Magnitude of Change

11.6.26 The magnitude of change to the existing view would be 'Low' as the views of the plant are limited and views are already dominated by the existing industrial infrastructure.

Impact

11.6.27 It can be concluded, that the impact to the receptor would be *minor* and *not significant*.

Viewpoint 3

11.6.28 The photomontage shown in Figure 11.8 shows the predicted view from Hadleigh Castle, approximately 8.6 km north east of the GEC site

11.6.29 The GEC development is barely visible behind the collection of stack, tanks and other features of the oil refinery.

Receptor Sensitivity

11.6.30 As it is located in a recreational area designated as a country park the receptor is considered to have a 'Medium' level of sensitivity to changes in views.

Magnitude of Change

11.6.31 The magnitude of change to the existing view would be 'negligible' with the plant concealed to a significant extent by the oil refinery and associated infrastructure.

Impact

11.6.32 Using the significance tables it can be concluded, that the impact to the receptor would be *Minor* however in actual fact views are so limited such that there would almost be *no impact* from this location.

Viewpoint 4

11.6.33 The photomontage shown in Figure 11.9 shows the view from the farm road near to Swigshole, approximately 7.0 km south east of the GEC site across open fields and marshland towards the site.

11.6.34 The oil refinery stacks and silos can easily be identified in the centre of the photograph with the GEC plant clearly visible to the left of the existing tanks that border the proposed Development site.

Receptor Sensitivity

11.6.35 The receptor is considered to have a 'Medium' sensitivity due to the presence of a few scattered residential properties and the footpath from which the picture was taken.

Magnitude of Change

11.6.36 The magnitude of change to the existing view would be 'negligible' as whilst the plant would be noticeable it would not greatly alter the views from the location which are already strongly influenced by the existing oil refinery, CECL Power Station and other industrial features.

Impact

11.6.37 It can be concluded, that the impact to the receptor would be *Minor* and *not significant* due to the limited change in the views from this location.

Viewpoint 5

11.6.38 The photomontage shown in Figure 11.10 shows the predicted view from High Halstow at the corner of Cooling Road and Wybournes Lane, approximately 8.0 km south east of the GEC site across numerous fields looking north-west towards the site.

11.6.39 The GEC plant can be seen against the horizon in the middle of the picture to the west of the Coryton Oil Refinery. The plant is more or less fully visible from this location albeit that due to distance it is not an especially noticeable feature in the landscape.

Receptor Sensitivity

11.6.40 The receptor is considered to have a 'High' sensitivity, close as it is, to the village of High Halstow, a wildlife reserve and a designated National Trail.

Magnitude of Change

11.6.41 The magnitude of change to the existing view would be 'Negligible' as the proposed plant, whilst visible, would be seen in the context of a much wider block of industrial development that would dwarf the GEC Development.

Impact

11.6.42 Abiding by the significance criteria established in Section 11.4 it can be concluded, that the impact to the receptor would be *Moderate/Minor* and *not significant*. However it could be reasoned that the impact was more likely to be *Minor* given the nature of the view.

Viewpoint 6

11.6.43 The photomontage shown in Figure 11.11 shows the predicted view from Cooling, approximately 6.4 km south of the GEC site.

11.6.44 The GEC plant can be seen against the horizon in the middle of the picture to the west of the Coryton Oil Refinery. The plant is more or less fully visible from this location albeit that due to distance it is not an especially noticeable feature in the landscape. Some lower parts of the plant are obscured by the reeds in the foreground.

Receptor Sensitivity

11.6.45 The receptor is considered to have a 'High' sensitivity, being close to a number of residential properties, a wildlife reserve and a designated National Trail.

Magnitude of Change

11.6.46 The magnitude of change to the existing view would be 'Negligible' as was the case for viewpoint 5 as the proposed plant, whilst visible, would be seen in the context of a much wider block of industrial development that would dwarf the GEC Development.

Impact

11.6.47 It can be concluded, that the impact to the receptor would be *Moderate*/*Minor* and *not significant*. However, as for viewpoint 5 it could be reasoned that the impact was more likely to be *Minor* given the nature of the view.

<u>Viewpoint 7</u>

11.6.48 The photomontage shown in Figure 11.12 shows the predicted view from Cliffe Marshes northern border with the River Thames, approximately 2.5 km south of the GEC site across the river towards the site.

11.6.49 The GEC Development is clearly visible on the opposing side of the river next to the tank farm. It is possible to see the majority of the plant including many of the lower lying buildings and water tanks.

Receptor Sensitivity

11.6.50 The receptor is considered to have a 'Medium' sensitivity given its nature as a recreational area (footpath).

Magnitude of Change

11.6.51 The magnitude of change to the existing view would be ''Low' as whilst the proposed plant would be clearly noticeable from this location, which is after all very close to the proposed site, the project would be seen in the context of the oil refinery and associated infrastructure which strongly influences the existing view.

Impact

11.6.52 The impact to the receptor would be *Moderate*/*Minor* and *not significant*.

<u>Viewpoint 8</u>

11.6.53 The photomontage shown in Figure 11.13 shows the view from Coalhouse Fort near East Tilbury, approximately 6.5 km south west of the GEC site across marshland looking towards the site.

11.6.54 The GEC plant can be seen in the centre of the photomontage o the left of the oil refinery.

Receptor Sensitivity

11.6.55 The receptor is considered to have a 'High' sensitivity due to its historic setting close to a number of residential properties and proximity to footpaths and a cycleway.

Magnitude of Change

11.6.56 The magnitude of change to the existing view would be 'Negligible' as the plant would only be visible in the distance and in the context of the oil refinery and other associated industry.

Impact

11.6.57 It can be concluded, that the impact to the receptor would be *Moderate*/*Minor* and potentially *not significant.* However, it could be reasoned that the impact was more likely to be *Minor* given the nature of the view.

<u>Viewpoint 9</u>

11.6.58 The photomontage shown in Figure 11.14 shows the view from Oak Farm near Corringham, approximately 3.2 km west of the GEC site across open fields looking towards the site.

11.6.59 The GEC plant can be seen to the right of the existing stack at the CECL Power Station and oil refinery. The plant is clearly visible against the skyline behind the various transmission lines towers and pylons.

Receptor Sensitivity

11.6.60 The view from this location is indicative of some of the views that would be experienced from the south and east of Corringham. The viewpoint is therefore considered to have a 'High' sensitivity to change due to the number of residential properties in the area.

Magnitude of Change

11.6.61 The magnitude of change to the existing view would be 'Negligible' as whilst the plant would be visible from this location the view is dominated by transmission lines, the oil refinery and other industrial / man made features.

Impact

11.6.62 It can be concluded, that the impact to the receptor would be *Moderate*/*Minor* and *not significant*.

<u>Viewpoint 10</u>

11.6.63 The photomontage shown in Figure 11.15 shows the view from the Wat Tyler Country Park, approximately 3.9 km north of the GEC site.

11.6.64 The proposed plant can be seen to the right of the existing tank farm and oil refinery.

Receptor Sensitivity

11.6.65 The receptor is considered to have a 'High' sensitivity representing the views of recreational users of the Country Park.

Magnitude of Change

11.6.66 The magnitude of change to the existing view would be 'Low' as the proposed plant would barely be noticeable against the backdrop of the existing industrial infrastructure.

Impact

11.6.67 It can be concluded, that the impact to the receptor would be *Moderate*/*Minor* and *not significant*.

TABLE 11.11: SUMMARY OF VISUAL IMPACT ASSESSMENT FROM ILLUSTRATIVE VIEWPOINTS

No.	***Location***	***Sensitivity of Visual Receptor***	***Visual Impact Assessment***
1	Oozedam Country Road	Medium	*Moderate / Minor*
2	Road Bridge on the Canvey Way (A130)	Low	*Minor*
3	Hadleigh Castle	Medium	*Minor*
4	Swigshole	Medium	*Minor*
5	Northward Hill (Corner of Cooling Road and Wybournes Lane)	High	*Moderate / Minor to Minor*
6	Cooling	High	*Moderate / Minor to Minor*
7	Cliffe Marshes Northern border with Thames	Medium	*Moderate / Minor*
8	East Tilbury – Coalhouse Fort	High	*Moderate / Minor*
9	Oak Farm	High	*Moderate / Minor*
10	Wat Tyler Country Park	High	*Moderate / Minor*

11.7 Mitigation Measures and Monitoring Programmes

Construction

11.7.1 A Construction Management Plan would be prepared in support of the proposed site development.

11.7.2 The Construction Management Plan would attempt to minimise any potential landscape and visual impacts during construction by addressing the following:

- Careful placement of the temporary storage of topsoil and any other material considered of value for retention;
- Provision of wheel washing facilities and soil dampening will ensure that debris and soils do not escape to the surrounding environment; and
- Careful design and layout of site construction areas including the location and type of temporary security fencing and lighting.

Operation

11.7.3 Overall, the main element of mitigation incorporated into the scheme to prevent, reduce or offset any adverse effects has been the careful siting of the proposed plant and associated infrastructure. In doing so the need for extensive works on pipelines and transmission lines has been minimised.

11.7.4 With regard to the layout of the site, a conscious effort was made in the feasibility stages of the project design to align the plant buildings with the design principals of the LG Development.

11.7.5 The GEC development will, in the future, likely benefit from a scheme of planting implemented as part of the surrounding LG Development that will help to minimise the impact of lower lying plant items such as the water tanks, administration building, stores and other such buildings.

11.7.6 Other mitigations measures proposed include the following typical conditions associated with the development of a power station in the UK:

- The final architectural design of the plant will be sensitive to the suggestions of local planning officers and LG;
- The final architectural design of the buildings will be carefully considered to provide a high standard of visual amenity, given practical and economic constraints; and
- The external structures will be designed such that there will be minimal deterioration in the appearance of GEC over its lifetime.

11.7.7 A limited combination of materials will be used in the construction of the external structures at GEC to give it a cohesive appearance. At upper levels, colour coated profiled sheeting will likely be used. At lower levels, including low level buildings, facing brickwork or dense concrete masonry will be used, where appropriate. A recessive colour scheme will be used in order to break up the impact of the built structures. The final colour scheme will be agreed with TTGDC and LG.

11.7.8 GEC will include the following lighting systems: site lighting; emergency lighting; road lighting; and, area floodlighting. Lighting systems will be designed to be similar to those used on the LG Development. Lighting systems will comply with current best practice and industry standards in order to minimise light spread and glare off site.

11.8 Assessment of Residual Effects

Construction

11.8.1 All temporary site construction areas at the GEC site will be re-instated in accordance with the methodology described in the mitigation section above.

11.8.2 As such the residual impacts associated with the temporary site construction area at the GEC site would be neutral.

Operation

11.8.3 Given the nature of the development it is not considered that there are any mitigation features that will greatly alter the impact discussed in Section 11.6 above. As such the residual impact after mitigation will remain as per Table 11.11. The impact of the plant is not considered to be significant in terms of landscape or visual impact due the industrial setting of the site and the project design which has been sensitive to the receiving landscape as has been demonstrated by the impact assessment undertaken.

11.9 Assessment of Cumulative Effects

11.9.1 The assessment above considers the impacts associated with the construction of GEC plant in the context of the existing site conditions. At the time of the undertaking of the LVIA there is one major development within the vicinity of the project with the potential to give rise to cumulative impacts in conjunction with the proposed GEC plant, this is the London Gateway Business Park and Port development.

11.9.2 The LG development has planning permission as discussed in Section 5 which also discusses the key aspects of the project. An illustrative plan included in Figure 1.4.

11.9.3 When constructed the LG Development will substantially change the landscape of the area surrounding the GEC plant introducing a large number of warehouses/distribution depots, port facilities and associated infrastructure in to the landscape.

11.9.4 The LG Development will partially screen views of the GEC from the north, west and south. This will result in the majority of the smaller buildings being entirely screened with many of the larger buildings barely visible. It is predicted however that in the majority of cases views of the two 75 m stack will still be achievable.

11.9.5 The LVIA has considered the impact of the two projects together and it is considered that the impact of the GEC development will if anything reduce when seen in the context of the London Gateway development which has already received planning permission from the relevant authorities. As such the impact of the GEC will be no greater than that predicted in Table 11.11.

11.9.6 The landscape / visual impacts of any gas and CHP interconnections from the GEC will be minimal with the pipelines likely being located underground. In the case of the gas line there will be a requirement for a new off-take facility from the National Gas Grid however this is likely to be small and unobtrusive.

11.9.7 Landscape and visual impacts associated with the new HV connection to the electricity grid will be greater than those for the gas or CHP interconnections however it is difficult to quantify the impacts at present due to some uncertainty with regard to the final route design.

11.9.8 National Grid has proposed that the connection to the system would be via a new substation they propose to construct most likely at Mucking Flats. The feasibility study found that the most likely connection would be via an underground cable (due to spatial constraints) to a point north of the A1014 (The Manorway) Road and then via an over ground connection to the proposed NG substation most likely at Mucking Flats. This option has been identified as likely having the least environmental impact. It is however important to note that this route is the subject of on going studies. The proposed electrical connection will be the subject of a separate consent application in due course and a further EIA will be included as part of the application. Further details of the various route alternatives will be detailed that consent application as appropriate.

11.9.9 It is considered that a combination of underground cables and over ground transmission lines would not be out of keeping with the surrounding landscape and as such is unlikely to give rise to significant cumulative impacts.

SECTION 12

ECOLOGY

12 ECOLOGY

12.1 Summary

12.1.1 Following many years of ecological survey work for the LG site which has included surveys of the GEC site footprint, the presence of on site ecology is well understood and documented. GEC occupies only a small part of land within the larger LG site for which a number of Consents and Permissions have already been granted.

12.1.2 An extensive series of Phase 1 and Phase 2 Habitat and Protected Species surveys have been undertaken on the LG Development, including on the proposed GEC site, since 2002. Protected Species were identified both within the wider LG Development site as well as within the proposed GEC site.

12.1.3 In advance of any construction works a program of remediation and clearance works is to be undertaken across the GEC site. This will be undertaken under the licences already issued for the LG Development. This program of works has commenced but has not yet been completed.

12.1.4 As such, the land within the GEC site footprint will be cleared of all buildings and vegetation, levelled and provided to GEC, devoid of any ecological interest.

12.1.5 The proposed GEC scheme has the potential to impact directly and indirectly on the Valued Ecological Receptors (VERs) during both the construction and operation phases. The impacts during construction include habitat loss, mortality, disturbance and pollution. The impacts during operation include a slight reduction in air quality and an increase in disturbance and pollution.

12.1.6 Impacts of a low magnitude of significance are expected to occur on one Statutory Ecological Designated Site; Thundersley Great Common SSSI to the north east of the GEC site. However this potentially significant impact prediction is based on a worst case operational mode that is unlikely to occur. No other VERs would be affected as they are either too far away from the proposed GEC site or in the case of on site VERs have already been displaced or translocated off-site as part of the wider LG Development.

12.2 Introduction

12.2.1 This Section addresses the potential ecology and nature conservation impacts of GEC in relation to the development proposals. It reviews and assesses the baseline ecological status of both the existing and future GEC site and surroundings, and identifies those features of conservation interest or importance that require consideration in the assessment with regards to potential impacts resulting from GEC scheme.

12.2.2 The GEC footprint forms only a small part of the larger LG Business and Logistics Park, for which Outline Planning Permission has already been granted. Following many years of ecological survey work for the LG Business and Logistics Park, the presence of on site ecology is well understood and documented. Under the planning permission for the LG Business and Logistics Park, the land within the GEC site will be cleared of all buildings and vegetation, levelled and provided to GECL devoid of any significant ecological constraints.

12.2.3 Construction on the wider LG Development has commenced, and the clearance works are underway but not completed. It is for this reason that two baseline scenarios are considered within this Section. These are:

- The Existing Baseline:
  This describes the site prior to any clearance works, in its natural state, as recorded in Spring 2009.

- The Future Baseline:
  This reflects the site post-clearance and represents a site devoid of any ecological features. It is envisaged that the future baseline will act as a true representation of the site as of 2011 and, more importantly, before the proposed GEC development commences.

12.2.4 It should be noted that there have been no habitat or species surveys undertaken specifically for the GEC site. The existing baseline scenario data has been compiled from the surveys completed as part of the LG Development. The first surveys were undertaken in 2001 and were updated in the eight years that followed. The latest surveys were completed in 2008. The future baseline scenario has assumed that there will be no vegetation or species present on site when the proposed development commences.

12.3 Key Legislation and Planning Policies

12.3.1 Section 3 provides the planning policy content. The policies listed below have informed the assessment process, to which reference has been made in Section 3. A full transcript of these policies is contained in Volume 2 Appendix A.

East of England Plan

SS8	The Urban Fringe
SS9	The Coast
ENV1	Green Infrastructure
ENV3	Biodiversity and Earth Heritage

Thurrock Borough Local Plan

LN12	Development Proposals and Nature Conservation
LN15	Site of Importance for Nature Conservation
LN16:	Areas of Local Nature Conservation Significance and Ecological Corridors

12.3.2 Furthermore, the following Legislation, Policy and Guidance Documents have been used to underpin the ecological impact assessment reported in this Section:

- Habitats and Species Directive (92/43/EEC) 1992;
- Bern Convention (on the Conservation of European Wildlife & Natural Habitats; and on the Conservation of Migratory Species of Wild Animals) 1979;
- The Convention on Wetlands of International Importance, especially as Waterfowl habitat 1971 (Ramsar Convention).
- Conservation (Natural Habitats & c.) Regulations 1994 (as amended);
- Wildlife & Countryside Act 1981 (and amended);
- Countryside and Rights of Way Act 2000;
- Planning Policy Statement on Biodiversity and Geological Conservation (PPS9);
- ODPM Circular 06/05: Biodiversity and Geological conservation - Statutory obligations and their impact within the planning system;
- Natural Environment and Rural Communities (NERC) Act 2006;
- Protection of Badgers Act 1992;
- The UK Biodiversity Action Plan (UKBAP) 2002;
- Essex Biodiversity Action Plan;
- Thurrock Biodiversity Action Plan; and,

- Thurrock Local Plan: Chapter 5; Landscape and Nature Conservation.

12.4 Assessment Methodology and Significance Criteria

12.4.1 The assessment methodology employed here follows the Ecological Impact Assessment Guidance issued by the Institute of Ecology and Environmental Management (IEEM) (2006).

12.4.2 The method involves five key stages:

- Stage 1: Consultations;
- Stage 2: Baseline Studies and Evaluation of Ecological Receptors;
- Stage 3: Identification of Valued Ecological Receptors;
- Stage 4: Identification and Characterisation of Potential Impacts; and
- Stage 5: Assessment of Significant Effects.

12.4.3 These stages and their associated methodologies are described below.

Stage 1: Consultations

12.4.4 During the initial ecological scoping stage, meetings were held with English Nature, Royal Society for the Protection of Birds (RSPB), the Environment Agency (EA) and Essex Wildlife Trust (EWT).

12.4.5 Given the overall project scale, following the commencement of the LG Development, a technical group for Nature Conservation was set up in February 2002. The technical group comprised representatives from the afore-mentioned Statutory and Non-Statutory bodies as well as Thurrock Borough Council and the ecological consultants involved.

Stage 2: Baseline Studies and Evaluation of Ecological Receptors

12.4.6 Baseline information regarding ecological features including sites of importance for nature conservation, species populations, species assemblages and habitats was obtained from several key sources. These included desk studies and ecological field surveys. Details of these studies and surveys are given below.

<u>Desk Studies</u>

12.4.7 An initial data search was undertaken as part of the initial LG Business and Logistics Park in 2002, prior to the detailed habitat and species surveys. This has subsequently been updated.

12.4.8 The objective was to gather all previously held historic data on any protected or notable species located within the ‘Zone of Influence’. The ‘Zone of Influence’ is the area within which impacts from the proposed GEC scheme may be anticipated. For GEC, the ‘Zone of Influence’ is estimated to be a 2 km radius from the centre of the site footprint.

12.4.9 Details of any Statutory Ecological Designated Sites located within a 10 km radius or Non-Statutory Ecological Designated Sites within a 5 km radius were also collected. This helped ensure that Designated Sites that might be subject to effects, particularly associated with air quality, were identified and considered in the assessment.

12.4.10 Data was requested from the following organisations (P&O and Shell, 2004):

- English Nature (EN),
- Joint Nature Conservation Committee (JNCC),
- Essex Wildlife Trust (EWT),
- London, Essex and Hertfordshire Amphibian and Reptile Trust,

- Shell and ex-Shell employees with an interest in wildlife,
- Local fishing clubs including the Essex Angling Consultative Association,
- Department for the Environment, Fisheries and Rural Affairs (DEFRA),
- Royal Society for the Protection of Birds (RSPB),
- British Trust for Ornithology (BTO).

Ecological Field Surveys

12.4.11 A range of ecological, update and monitoring surveys have been undertaken in the LG Development site since 2002 (P&O and Shell, 2004).

12.4.12 The following surveys were undertaken in 2008:

- Phase 1 Habitat;
- Scarce and Locally Important Flora;
- Reptiles;
- Amphibians;
- Badgers;
- Water Voles;
- Bats;
- White Clawed Crayfish;
- Brown Hare;
- Terrestrial Invertebrates;
- Aquatic Invertebrates;
- Breeding Birds; and
- Wintering Birds.

Stage 3: Identification of Valued Ecological Receptors

12.4.13 It is impractical and inappropriate for an assessment of the ecological effects of a proposed development to consider every species and habitat that may be affected equally and consistently. Instead, it is sensible to focus on 'Valued Ecological Receptors' (VER). VERs are species and habitats present within the 'Zone of Influence' of the proposed development that are of sufficiently high value that an effect upon them as a result of the proposed development could be considered significant.

12.4.14 There is also potential that the GEC scheme will have an impact on species which have not been deemed VERs but still have a level of legal protection. In such cases, the impacts have been considered and mitigation proposed alongside the VERs.

12.4.15 The value of sites, populations of species, species assemblages and habitats were evaluated with reference to their:

- Importance in terms of 'Biodiversity Conservation Value' (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations, rarity, replaceability and sensitivity);
- Legal Status; and
- Local and National Conservation Status (taken from local and national policies such as UKBAP, LBAP and Local Plans).

12.4.16 For the purposes of this assessment, sites, species populations, species assemblages and habitats were valued using the following geographical scale:

- International;
- European;
- UK;
- National (i.e., England);
- Regional;
- County;
- District;
- Local; and
- Neighbourhood.

12.4.17 The valuation of sites makes use of any established systems. Examples are provided in Table 12.1. However, professional ecological judgement has been used to attribute value to receptors considered to be of district value or below.

TABLE 12.1: EXAMPLE OF CRITERIA USED TO EVALUATE ECOLOGICAL RECEPTORS

Level of Value	***Examples of Definitions***
International	An Internationally Important Site, *e.g.* Special Protection Area (SPA), Special Area of Conservation (SAC) or Ramsar site (or a site considered worthy of such designation); a regularly occurring population of an internationally important species (listed on Annex IV of the Habitats Directive).
National (UK)	A Nationally Designated Site, *e.g.* SSSI, or a site considered worthy of such designation; a viable area of a habitat type listed in Annex 1 of the Habitats Directive, or smaller areas of such habitat which are essential to maintain the viability of a larger whole; any regularly occurring population of a nationally important species, *e.g.* listed on Schedules 5 and 8 of the Wildlife & Countryside Act (1981); a feature identified as of priority in the UK BAP.
County	Areas of Internationally or Nationally Important Habitats which are degraded but are considered readily restored; viable areas of key habitat identified in Local BAPs, or smaller areas of such habitat which are essential to maintain the viability of a larger whole; a site designated as a Wildlife Site or Site of Nature Conservation Interest (SNCI); a regularly occurring, locally significant number of a nationally important species.
District	Areas of Habitat identified in a Sub-County (District / Borough) or in the relevant Natural Area profile; district sites that the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves; sites or features that are scarce within the district or borough or which appreciably enrich the district or borough habitat resource; a diverse or ecologically valuable hedgerow network.
Local	Areas of Internationally or Nationally Important Habitats which are degraded and have little or no potential for restoration; a good example of a common or widespread

Level of Value	*Examples of Definitions*
	habitat in the local area.
Neighbourhood (site and its vicinity, including areas of habitats contiguous with or linked to those on site)	Areas of heavily modified or managed vegetation of low species diversity or low value as habitat to species of nature conservation interest; common and widespread species.

12.4.18 The valuation of species populations, assemblages of species, and habitats uses accepted significance criteria. Examples of these significance criteria are described below.

- Species Populations
  The importance of populations is evaluated on the basis of their size, recognised status (e.g., published lists of species of conservation concern and Biodiversity Action Plan (BAP) status) and legal protection status.
  For example, bird populations exceeding 1 per cent of published bio-geographic populations are considered to be of international importance, and those exceeding 1 per cent of published national populations are considered to be of national importance.
- Species Assemblages
  In some instances, it is the species assemblage that is of importance. Criteria used to evaluate the importance of assemblages include SSSI selection criteria.
  For further details, Fuller (1980) provides a framework for evaluating the relative importance of bird assemblages.
- Habitats
  Criteria for the evaluation of habitats and plant communities includes: Annex III of the EC Habitats Directive 'Guidelines for the Selection of Biological SSSIs'; and, where available, Local Authority and Wildlife Trust criteria for the selection of Local Sites (e.g., County Wildlife Sites). Legal protection status is also a consideration for certain habitats.

12.4.19 Within this assessment, sites, species populations, species assemblages and habitats are considered to be Valued Ecological Receptors (VER) if they are valued as being of local importance or higher. It is considered that no significant effect can occur to features considered to be below local importance, except where a feature has high social, economic, supporting or secondary value.

12.4.20 The description and valuation of ecological features will take account of any likely changes. For example, these include: trends in the population size or distribution of species; likely changes to the extent of habitats; and, the effects of other proposed developments or land-use changes.

Stage 4: Identification and Characterisation of Potential Impacts

12.4.21 The potential likely ecological impacts from the proposed GEC scheme during construction and operation are identified and characterised. In identifying these impacts, a number of parameters were taken into account.

12.4.22 The parameters used to determine the nature of the impact include:

- Magnitude
  The size or intensity of the effect measured in relevant terms. For example: the number of individuals lost or gained; area of habitat lost or created; or, the degree of change to existing conditions such as noise or lighting levels. The magnitude of an impact is further discussed below.

- Negative or Positive Effect
  Whether the effect of the impact would result in net loss or degradation of a VER or whether it would enhance or improve it.
- Extent
  The spatial scope of the effect. For example: the physical area affected; or, the geographical pattern of the effect.
- Duration
  The length of time over which the effect occurs.
- Reversibility
  The extent to which effects are reversible, either spontaneously or through active mitigation.
- Timing and Frequency
  Consideration of the timing of events in relation to ecological change. Some effects may be of greater significance if they take place at certain times of year, such as during the breeding bird season. The extent to which an effect is repeated may also be of importance.

Establishing the Magnitude of Impact

12.4.23 Impacts can be permanent or temporary, direct or indirect and can be cumulative. These factors are brought together to assess the magnitude of the impact on particular VERs and, wherever possible, the magnitude of the impact is quantified. Professional judgment is then used to assign the effects on the receptors to one of four classes of magnitude, defined in Table 12.2.

12.4.24 It should be noted that this step in the impact assessment procedure does not follow the procedure described within the IEEM guidelines but has been included to allow comparison between other environmental disciplines which attribute a magnitude of impact, and also to provide transparency in how decisions over whether an impact is significant has been reached.

TABLE 12.2: DEFINITION OF MAGNITUDE

Magnitude	***Definition***
High	A permanent or long-term impact on the extent, size or integrity of a site, habitat, species assemblage or community, population or group. If adverse, this is likely to threaten its sustainability; if beneficial, this is likely to enhance its conservation status.
Medium	A permanent or long-term impact on the extent or size or integrity of a site, habitat, species assemblage or community, population or group. If adverse, this is unlikely to threaten its sustainability; if beneficial; this is likely to be sustainable but is unlikely to enhance its conservation status.
Low	A permanent or long-term reversible impact on a site, habitat, species assemblage or community, population or group whose magnitude is detectable but would not threaten its integrity.
Negligible	A short-term, reversible impact on the extent or size or integrity of a site, habitat, species assemblage or community, population or group that is within the normal range.

12.4.25 Potential impacts are characterised initially in the absence of any mitigation, except where this is integral to the design of the proposed GEC scheme, such as the inclusion of technology to reduce the emission of air borne pollutants from the stack.

Any additional mitigation or compensation proposed is later identified and its likely effectiveness assessed.

Stage 5: Assessment of Residual Effects

12.4.26 The significance of the predicted effects on VERs arising from the identified impacts of the proposed GEC scheme, including designed-in and additional mitigation measures are assessed.

12.4.27 Significance is assessed as Negative, Positive or Not Significant.

Negative

12.4.28 For habitat and species, a negative effect is considered to be significant if the favourable conservation status of a VER is compromised by the final design of the proposed GEC scheme. Conservation status is defined by the IEEM (2006) as being:

- Habitats
  "*Conservation status is determined by the sum of the influences acting on the habitat and its typical species that may affect its long-term distribution, structure and functions as well as the long-term survival of its typical species within a given geographical area*"; and
- Species
  "*Conservation status is determined by the sum of the influences acting on the species concerned that may affect the long-term distribution and abundance of its populations within a given geographical area*".

12.4.29 The decision as to whether the favourable conservation status of a VER is likely to be compromised is made using professional judgement based on an analysis of the predicted effects of the proposed GEC scheme (including consideration of the specific parameters outlined above).

12.4.30 A similar procedure is used for Statutory Ecological Designated Sites that could be affected, except that the focus is on the effects on the integrity of each site, defined as "*the coherence of ecological structure and function, across a site's whole area, that enable it to sustain the habitat, complex of habitats and/or levels of populations of species for which it was classified*." This assessment is made with reference to the features for which a Site has been classified / notified and involves combining assessments of the effects on the conservation status of each of these features.

12.4.31 For Non-Statutory Ecological Designated Sites, such features may not have been formally defined and in these cases a description of the site (and where possible the reason for designation) was used to assess the likely habitats and species within these sites. This information was gained primarily from the Desk Study.

Positive

12.4.32 A positive effect is considered to be significant if development activities cause:

- A non-valued ecological receptor to become valued;
- Restoration of favourable conservation status for a habitat / species population; and / or,
- Restoration of a site's integrity (where this has been undermined).

12.5 Baseline Conditions and Valued Ecological Receptors

Overview of the Site

12.5.1 The GEC site, on the north bank of the River Thames Estuary, is situated on land within the LG Development. More specifically on land within the LG Business and Logistics Park.

12.5.2 It is dominated by open species-poor semi-improved grassland (see Figure 12.1). Several small patches of bare ground are located to the north of a corridor of continuous scrub, stretching the width of the site (Thomson Ecology (4) 2008). The centre of the site is dominated by a series of artificial spoil mounds, south of a hard standing pathway. A series of water bodies of various sizes are scattered within the site boundary. Several are permanent ponds but most comprise standing rainwater. A linear ditch is located adjacent to the eastern boundary comprising shallow banks and measuring approximately 3 m across at its widest point.

12.5.3 The land to the north and west currently comprises similar grazed, species-poor semi-improved grassland and marsh, interspersed with a network of ponds and ditches and is undergoing extensive vegetation clearance and levelling works will be undertaken. Coryton Power Station is located to the east. The operational Power Station comprises buildings and hardstanding surfaces, with smaller areas of semi-improved neutral and amenity grasslands. The River Thames lies approximately 200 m to the south of the site separated from the proposed GEC scheme by the most easterly point of the LG Development, with a large amount of construction running east to west along the river.

Designated Sites

Statutory Ecological Designated Sites

12.5.4 There were 21 Statutory Ecological Designated Sites located within 10 km of GEC site. The closest of which are Vange and Fobbing Marshes SSSI and Holehaven Creek SSSI which are located approximately 1.5 km to the north and east respectively. Details of all Statutory Ecological Designated Sites are provided in Table 12.3 and their locations are shown in Figure 12.2.

TABLE 12.3: STATUTORY ECOLOGICAL DESIGNED SITES WITH 10 KM OF GEC

Designated Site	***Size (Ha)***	***Distance from GEC (km)***	***Description***
Thames Estuary and Marshes SPA and Ramsar site	4802	2 km south	Designated for supporting internationally important populations of over wintering avocets, hen harriers and ringed plovers.
Benfleet and Southend Marshes SPA Ramsar site	2374	6.5 km north east	Designated for supporting internationally important populations of dark-bellied brent geese, knot, grey plover and migrant ringed plovers.
South Thames Estuary & Marshes SSSI	5289	2 km south	Tidal mudflat supporting thousands of breeding and wintering birds at low tide. Including shelduck, dunlin, curlew, oyster catcher and lapwing.
Benfleet and Southend Marshes SSSI	2374	6 km north east	Salt marshes, mud flats, scrub and grassland supporting a diverse flora and fauna.
Vange and Fobbing Marshes SSSI	167.3	1.5 km north	Unimproved coastal grassland and associated dykes and creeks support a diversity of nationally uncommon or rare maritime plants
Mucking Flats and Marshes SSSI	313	2 km south west	Mudflats, salt marsh and sea wall grassland important for wintering wildfowl and waders. Ringed plovers occur in large numbers with nationally important populations of shelduck, grey plover, dunlin, black-tailed godwit and redshank.
Holehaven Creek SSSI	272	2 km north east	Nationally and internationally important numbers of black-tailed godwits
Pitsea Marsh SSSI	92	4 km north	Mosaic of scrub, grassland, reedbed, fen, open water and salt marsh supporting an outstanding range of invertebrates.
Basildon Meadows SSSI	7	5.5 km north west	Comprises unimproved herb-rich meadows.
Northward Hill SSSI	53	7 km south east	The site supports the largest heronry in Britain. Breeding birds and insect fauna are also of importance.
Chattenden Woods SSSI	128	8.5 km south	This woodland is a rare example of coppice-with-standard woodland in Kent.
Dalham Farm SSSI	9	8 km south east	This site is designated for its geological interests.

Thundersley Great Common SSSI	9	10 km north east	It is dominated by a range of acidic grass / heath plant communities.
Canvey Wick SSSI	128	3 km north east	Supports a nationally important assemblage of invertebrates associated with herb-rich habitats.
Leigh NNR	257.5	9.5 km north east	Dominated by eel grass and salt marsh species. The site also supports many invertebrate species and large numbers of dark-bellied Brent geese and waders such as grey plovers and knots.
High Halstow Northward Hill NNR	52.51	7 km south east	This scrubland has a diverse bird population, including long-eared owl and nightingale, while the oak woodland supports a large heronry. The elm woodland is home to a colony of white letter hairstreak butterflies.
Linford LNR	3.44	6 km south west	Woodland
Grove House Wood LNR	2.24	4.5 km west	Woodland
Vange Hill LNR	11.44	6 km north west	Grassland and scrub
Canvey Lake LNR	8.27	6.5 km north east	Wetland and a large water body.
Belton Hills LNR	21.99	10 km north east	Managed scrub on a former open grassland. Supports a variety of notable flora and invertebrate species.

Non-Statutory Ecological Designated Sites

12.5.5 There were two Non-Statutory Ecological Designated Sites located within 5 km of the GEC site. These sites are afforded a level of protection through the planning process and represent a tier of nature conservation interest below that of the Statutory Ecological Designated Sites. Details are provided in Table 12.4 and their locations in Figure 12.3.

TABLE 12.4: NON-STATUTORY DESIGNED SITES WITH 5KM OF GEC

Designated Site	***Size (Ha)***	***Distance from GEC***
Watt Tyler County Park	44.17	4 km north
Corringham Marshes SINC	206.88	1 km north and west

Existing Baseline

Species

Notable and Scarce Flora

12.5.6 A species is considered nationally scarce if recorded in 100 or fewer of the 10 km x 10 km squares that make up Great Britain. Locally important species are regionally rare and designated if recorded in 15 or fewer of the 1 km x 1 km squares that make up Essex. The historic records indicated there were several species of nationally scarce and locally important species within 2 km of the proposed GEC site.

12.5.7 During the 2002 survey, one nationally scarce species, divided sedge (*Carex divisa*) was recorded within the proposed GEC site (Thomson Ecology (8) 2008). Three divided sedge plants, typical of grazed salt marshes were recorded within the centre of the site. Narrow-leaf Bird's-foot Trefoil (*Lotus glaber*), Grass Vetchling (*Lathyrus nissolia*) and perennial wall-rocket (*Diplotaxis tenuifolia*), all locally important species were also recorded within the proposed site.

12.5.8 Within the wider LG Business and Logistics Park site, four nationally scarce species were identified; divided sedge, broad-leaved spurge (*Euphoria platyphyllos*), dittander (*Lepidium latifolium*) and stiff salt marsh-grass (*Puccinellia rupestris*). Divided sedge, dittander and stiff salt marsh-grass, though nationally scarce, are relatively common within southern Essex. A further 22 species of local importance were also recorded within the greater LG Business and Logistics Park site.

12.5.9 This initial survey was supplemented by an update survey in 2008. Several small populations of divided sedge, dittander and stiff salt marsh-grass were re-recorded throughout the LG Business and Logistics Park site but broad-leaved spurge was not recorded. None of the plants were recorded within the proposed GEC site although four stiff salt marsh-grass plants were located approximately 100 m to the north.

12.5.10 Another nationally scarce plant, not previously recorded, annual beard grass (*Polypogon monspeliensis*) was identified in one location approximately 2 km to the west of the proposed GEC site.

12.5.11 Although comparatively small, the proposed GEC site supports several locally important species but currently, no nationally scarce species. It has, however, historically supported divided sedge and continues to support suitable habitats for this species. For this reason the site is considered to be of district value for notable and scarce flora.

Reptiles

12.5.12 The four common reptile species, adder (*Vipera berus*), grass snake (*Natrix natrix*), common lizard (*Zootoca vivipara*) and slow worm (*Anguis fragilis*), are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) against deliberate and / or intentional killing, injuring and trade.

12.5.13 The plot and surrounding LG Business and Logistics Park have been identified as containing optimal and sub-optimal habitat suitable for protected species including water voles, great crested newts, reptiles and bird species. The proposed GEC site and surrounding land area have been a focus of a licensed trapping and translocation programme for these species. This work has been undertaken within the bounds of six licences currently submitted to Natural England and conducted under the appropriate Regulations.

12.5.14 The reptiles species recorded on site are UK BAP species and protected by law but are present in relatively small numbers. Reptiles are therefore considered to be of district value.

Amphibians

12.5.15 In England, the common frog (*Rana temporaria*), pool frog (*Pelophylax lessonae*), common toad (*Bufo bufo*), smooth newt (*Triturus vulgaris*), palmate newt (*Triturus helveticus*) and great crested newt (*Triturus cristatus*) are all protected under the Wildlife and Countryside Act 1981 (as amended) against intentionally killing, injuring or capturing. The great crested newt (*Triturus cristatus*) is a European Protected Species protected under the EU Habitats Directive and the Habitats Regulations, 1994 (as amended). It is also illegal to damage, destroy or intentionally or recklessly obstruct access to their breeding or resting places. All life stages of great crested newts are afforded the same level of protection. Great crested newts and toads are UK BAP species and great crested newts are also Essex BAP species.

12.5.16 A small population of great crested newts, less than 10 individuals, was recorded in the water bodies on site (Thomson Ecology (13 & 14) 2008). This population is considered to be part of a larger meta-population distributed across the LG Business and Logistics Park development. Smooth newts (*Triturus vulgaris*) and palmate newts (*Triturus helveticus*) were also recorded in the vicinity but not within the GEC site boundary. No other amphibians were recorded within the GEC site.

12.5.17 The GEC site and surrounding LG Business and Logistics Park have been identified as containing optimal and sub-optimal habitat suitable for protected species including water voles, great crested newts, reptiles and bird species. The proposed GEC site and surrounding LG Business and Logistics Park have been a focus of a licensed trapping and translocation programme for these species. This work has been undertaken within the bounds of six licences currently submitted to Natural England and conducted under the appropriate Regulations.

Badgers

12.5.18 Badgers (*Meles meles*) and their setts are protected under the Protection of Badgers Act (1992). Licenses are required from NE to exclude badgers from an active sett and to ‘close’ it if there would be a direct impact from proposed GEC development. Inactive setts are afforded less protection.

12.5.19 The Desk Study showed that there was an active badger sett within the greater LG Business and Logistics Park site. In addition a local farmer has observed active setts within his land to the west of the LG Development site.

12.5.20 Evidence of badgers was recorded in the LG Business and Logistics Park site but not within the proposed GEC site (P&0 and Shell, 2004). The majority of the badger activity was in the grazing marshes, approximately 2 km to the west of the proposed GEC site. There was also some evidence of badgers, approximately 1 km to the north of the proposed GEC site. The GEC site offers limited potential for foraging although the value of the area to badgers is considered to be not significant in the context of the surrounding habitats. The site is considered to be of negligible value for badgers

Water Vole

12.5.21 Water voles (*Arvicola terrestris*) are protected under the Wildlife and Countryside Act 1981 (as amended). It is an offence to possess, control or sell water voles or to intentionally kill, injure or take them. It is also an offence to intentionally or recklessly damage, destroy or obstruct access to a place that water voles use for shelter or protection or disturb them whilst using such a place. Water voles are also a UK and an Essex BAP species.

12.5.22 The GEC site and surrounding LG Business and Logistics Park land have been identified as containing optimal and sub-optimal habitat suitable for protected species including water voles, great crested newts, reptiles and bird species. The proposed GEC site and surrounding LG Business and Logistics Park land area have been a focus of a licensed trapping and translocation programme for these species. This work has been undertaken within the bounds of six licences currently submitted to Natural England and conducted under the appropriate Regulations.

12.5.23 Evidence of mink (*Mustela vison*) was recorded to the south of the proposed GEC site within the LG Port development area. Mink are acknowledged to be one of the key reasons for the recent dramatic decline in the national water vole population and their presence may explain the lack of evidence on site during the 2008 surveys.

12.5.24 For the purposes of this assessment the GEC site supports at least one water vole which is part of a larger population located throughout the wider LG Development site. The GEC site is therefore considered to be of local importance for water voles.

Bats

12.5.25 It is illegal to deliberately capture, injure or kill a bat and to intentionally or recklessly disturb bats. It is also illegal to damage, destroy or intentionally or recklessly obstruct access to a breeding or resting place used by a bat. The legislation is contained within the Wildlife and Countryside Act 1981 (as amended) and The Habitats Regulations, 1994, (as amended). Pipistrelles species (*Pipistrellus spp.*), noctules (*Nyctalus nocula*) and brown long-eared (*Plecotus auritus*) bats are all UK BAP species. Pipistrelles are also Essex BAP species.

12.5.26 Historic records exist for bat sightings within 2 km of the proposed GEC site but not within it. Sightings include, brown long-eared bat, noctule, pipistrelle species and serotine (*Eptesicus serotinus*).

12.5.27 A series of different bat surveys were undertaken throughout the LG Business and Logistics Park site, including, dusk and dawn activity and tree and building surveys (Thomson Ecology (11) 2008). Two small Pipistrelle roosts were recorded within two buildings located on the old Shell Haven refinery, to the north of the GEC site, but have been removed under licence as part of the LG Business and Logistics Park development. The built structure located on the western boundary of the site was considered unsuitable for bats. Noctule, Leislers (*Nyctalus leisleri*) and pipistrelle were recorded commuting within the greater LG Business and Logistics Park area during the 2002 and the 2008 surveys but all in very low numbers and widely distributed across the site. The closest record to the GEC site itself was of a Leislers bat commuting along the rail corridor to the west of the GEC site in 2002.

12.5.28 The onsite water bodies offer limited potential as foraging habitat however no bats have been recorded within the GEC site itself. The remainder of the habitats within the GEC site is considered to be of negligible value to bats. Due to the lack of connectivity between the site and the surrounding landscape, and due to the absence of habitats considered to be of particular value to foraging bats, the GEC site is considered to be of negligible value for bats.

White Clawed Crayfish

12.5.29 White-clawed crayfish (*Austropotamobius pallipes*) are protected under Schedule 5 of the Wildlife and Countryside Act (1981) and The Conservation (Natural Habitats & c.) Regulations 1994. This species is also a UK and Essex BAP species.

12.5.30 The Desk Study revealed no records of this species on site and the ponds and drain within the site are considered unsuitable for this species. It is for this reason that the site is valued as being negligible for white clawed crayfish.

Brown Hare

12.5.31 The brown hare (*Lepus europaeus*) does not receive any protection under the Wildlife and Countryside Act (1981) (as amended). The protection they are afforded relates to hunting and not development; however they are UK and Essex BAP species and as such as a species of conservation priority.

12.5.32 Historical records prove the presence of this species within 2 km of the GEC site and one individual was recorded within the GEC site in 2002 (Thomson Ecology (7) 2008). No subsequent surveys note the presence of Brown Hare. However, the open grassland, patches of taller scrub and herbs and quiet nature of the LG Business and Logistics Park site are suitable for brown hares.

12.5.33 Although they have little legal protection, there is a target within the Thurrock BAP to maintain and increase the current number of breeding hares in the Thurrock area. The site is therefore considered to be local value to brown hares.

Terrestrial Invertebrates

12.5.34 A number of terrestrial invertebrates are also protected under the Wildlife and countryside Act 1981 (as amended) as are aquatic invertebrates. There are also several species on the UK and Essex BAPs.

12.5.35 The historic records indicated that there were several locations close to the proposed site which support significant invertebrate assemblages. Subsequently, surveys were undertaken in 2002 across the whole LG Development site.

12.5.36 In total 470 species of terrestrial invertebrate were identified, including two UK BAP species; the brown carder bee (*Bombus humilis*) and the shrill carder bee (*Bombus syvarum*) (P&0 and Shell, 2004). These two bees are both classified within the UK as endangered and Essex is known to be one of only seven known populations in the country for the shrill carder bee. Additionally, the LG Business and Logistics Park site also supports two nationally vulnerable species, four nationally rare species and 34 nationally notable species.

12.5.37 As the GEC site supports similar habitats and features to the rest of the LG Business and Logistics Park site, it can be assumed that it may support a proportion of the rare and notable invertebrate species. It is for this reason that the site is considered to be of district importance.

Aquatic Invertebrates

12.5.38 A number of aquatic invertebrates are protected under the Wildlife and Countryside Act 1981 (as amended). There is also a number which are in the UK and Essex BAP.

12.5.39 The historical data search revealed there are 4 vulnerable, 3 endangered, 16 rare and 77 nationally scarce species as well as many species of local importance within the surrounding area (Thomson Ecology (12) 2008). A radius for this search was not provided but the records indicated that the LG Business and Logistics Park site may be of interest for aquatic invertebrates and justified the 2001 surveys.

12.5.40 A number of drains and ponds within the LG Business and Logistics Park site, which included those on the proposed GEC site, were surveyed. A total of 58 species were recorded, one species, the scarce emerald damselfly (*Lestes dryas*) is listed as vulnerable in the UK red data book.

12.5.41 These surveys were supported by a series of repeat surveys in 2008. The pond located within the south west corner of the GEC site was surveyed and was recorded as being of poor quality for aquatic invertebrates, supporting 9 and 8 different taxa on each of the respective surveys. In total 30 different invertebrate families were recorded across the whole LG Business and Logistics Park site, including the emerald damselfly in a number of water bodies across the site but not within the pond on the GEC site.

12.5.42 The GEC site appears to support a small range of species compared to its surroundings and no rare, notable or legally protected species. However, only one of the water bodies on site was surveyed and the surrounding area is known to support many rare or notable species, subsequently the precautionary approach is to consider the site as being of local value for aquatic invertebrates.

<u>*Birds*</u>

12.5.43 The Wildlife and Countryside Act (1981) makes it an offence to intentionally kill, injure, or take any wild bird or their eggs or nests. For offences related to species listed on Schedule 1 there are additional offences in relation to reckless disturbance. All breeding birds and their nesting structures are also protected when they are occupied, principally between March and September.

Breeding Birds

12.5.44 The first breeding bird surveys were completed in 2001 and 2002 and were subsequently updated in 2008 (Thomson Ecology (5) 2008). These surveys covered the LG Development site and their immediate surroundings.

12.5.45 Amongst many common species, the initial surveys recorded three Schedule I and II UK BAP species. A similar assemblage of species was recorded during the 2008 surveys, details are provided in Table 12.5.

TABLE 12.5: THE NOTABLE AND PROTECTED BIRD SPECIES RECORDED IN THE LG DEVELOPMENT SITE IN 2001-2 AND 2008.

Common Name	***Latin Name***	***Legal Protection***	***Conservation Status[11]***	***Recorded in 2001/2 Surveys***	***Recorded in 2008 Surveys***
Barn owl	Tyto alba	Schedule I	Amber	Y	Y
Black redstart	Phoenicurus ochurros	Schedule I	Amber	Y	-
Bearded tit	Panurus biarmicus	Schedule I	Amber	Y	Y
Grey Partridge	Perdix perdix	UK BAP, L BAP, NERC	Red	Y	-
Lapwing	Vanellus vanellus	UK BAP NERC	Red	Y	Y
Sky Lark	Alauda arvensis	UK BAP, L BAP	Red	Y	Y
Song thrush	Turdus philomelos	UK BAP, L BAP, NERC	Red	Y	Y
Spotted flycatcher	Muscicapa striata	UK BAP, NERC	Red	Y	-
Starling	Sturbus vulgaris	UK BAP, NERC	Red	Y	Y

[11] Status refers to the birds conservation status as defined by Eaton *et al* 2009 (BTO).

House Sparrow	Passer domesticus	UK BAP, NERC	Red	Y	Y
Linnet	Carduelis cannabina	UK BAP, NERC	Red	Y	Y
Yellow hammer	Emberiza citronella	UK BAP, NERC	Red	Y	Y
Reed bunting	Emberiza shoeniclus	UK BAP, NERC	Amber	Y	Y
Corn bunting	Emberiza calandra	UK BAP, NERC	Red	Y	Y
Little Ringed Plover	Charadrius dubius	Schedule I	Green	-	Y
Hobby	Falco subbutteo	Schedule I	Green	-	Y
Cetti's warbler	Cettia cetti	Schedule 1	Green	-	Y
Bullfinch	Pyrrhula pyrrhula	UK BAP NERC	Amber	-	Y

NERC: species listed as being of principal importance under the NERC Act 2006 and therefore in need of a BAP.

12.5.46 Although it cannot be confirmed that any of these species were recorded within GEC site boundary and much of the suitable breeding habitat, such as trees or dense scrub, is absent, it could be said that the site could support limited numbers of bird species which prefer open flat grassland, such as the little-ringed plover, skylark or lapwing. Although the site has the potential to support Schedule I species, the GEC site comprises a small area of land within the LG Business and Logistics Park site and will therefore be less of important than the greater area. As such, the GEC site is considered to be of district value to breeding birds.

Wintering Birds

12.5.47 The first surveys were undertaken within the wider LG Development in 2001 and 2002 and were repeated in late 2007 to early 2008.

12.5.48 Amongst the many species recorded in the area the site supported five species which are noted as being integral to the notification to the South Thames Estuary and marshes SSSI (Thomson Ecology (6) 2008). These are redshank (*Tringa totanus*), shelduck (*Tadorna tadorna*), pintail (*Anas acuta*), teal (*Anas crecca*) and curlew (*Numenius arquata*). No species for which the two adjacent SPAs are notified were recorded on site. The surveys undertaken in 2008 offered a similar assemblage of species. No wintering Schedule I birds or UK or Essex BAP species were recorded.

12.5.49 The greater area supports very few notable or protected species during the winter. The site is considered to be of negligible value for wintering birds.

Other Species

12.5.50 No other notable or protected species or habitat to support such species were recorded within a 2km radius of the proposed site.

12.5.51 Several stands of Japanese Knotweed (*Fallopis Japonica*) were recorded 1km south east of the proposed site during the 2008 site surveys. All Japanese Knotweed has now been removed from the site.

Summary

12.5.52 Table 12.6, summarises the sites habitats and species which have been identified as VERs using the criteria specified in Table 12.1. It should be noted that receptors with a value of local or greater constitute VERs. These are shown shaded in the Table.12.6

TABLE 12.6: SUMMARY OF ALL SITES, HABITATS AND SPECIES ON SITE AND WITHIN THE LOCAL AREA.

VER	***Nature Conservation Value***
SPA	International
SSSIs and NNRs	National
LNRs	District
Notable and Scarce Species	Local
Reptiles	District
Amphibians	District
Badgers	Negligible ∞
Water Vole	Local
Bats	Negligible∞
White Clawed Crayfish	Negligible∞
Brown hare	Local
Terrestrial Invertebrates	District
Aquatic Invertebrates	Local
Breeding Birds	Local
Wintering Birds	Negligible∞

∞ Species have been assessed as lower than local value and are therefore not considered VERs.

Future Baseline

12.5.53 As previously described, the GEC site will be cleared under the planning permission of the LG Development. The following paragraphs provide an insight into how the GEC site will be cleared and how the proposed mitigation and management measures will be used to achieve this, eventually, resulting in the future baseline.

12.5.54 By 2011, which represents the start of the future baseline, the GEC site will comprise bare earth and hardstanding and will be devoid of vegetation. All habitats and species of value within the area will have been moved via a suite of mitigation measures which are described below. These mitigation measures have been assessed, agreed and will be implemented as part of the wider LG Business and Logistics Park environmental impact assessment process. They form an essential part of the LG Business and Logistics Park Planning Permission and subsequently lead to, and form an integral part of the future baseline.

12.5.55 Therefore the GEC site is considered to be of negligible value for all habitats and species at the 2011 future baseline.

12.5.56 As such the only VERs considered under the future baseline will be the Statutory Ecological Designated Sites and the Non-Statutory Ecological Designated Sites which were identified previously.

<u>Generic Mitigation of Impacts to VERs</u>

12.5.57 An Ecological Management and Mitigation Plan (EMMP) has been created for the LG Development. The implementation of the EMMP will ensure the cleared site is maintained; removing pioneer plants and preventing other species gaining access.

12.5.58 As part of the Outline Planning Permission for the LG Business and Logistics Park, the Harbour Enforcement Order for the LG Port development and the detailed Ecological Mitigation Strategies prepared for the area the following receptor sites have been identified:

- *Northern Triangle*
  Located 600 m north of the proposed GEC site, this 54 ha area consists of grazing pasture and ditches. This area is will be designed and managed specifically for great crested newts, reptiles and water voles.
- *Great Garlands Farm*
  An area of 200 ha of farmland and associated ditches, situated 1.5 km to the west of the proposed GEC site.
- *Site A*
  Located approximately 2.5 km to the west of the GEC site, it consists of 37 ha of arable farmland and ditches. Following the realignment of the sea wall, this area will be flooded to create mud flats for the benefit of waterfowl.
- *Site X*
  An area of 200 ha located to the south of the River Thames in Kent. The land is currently grazed and will be flooded to create further inter tidal mudflats for breeding and wintering birds.
- *Sandpool Farm*
  Located in Wiltshire and managed by Wiltshire Wildlife Trust as a nature reserve. The site comprises 19 ha of rough, species rich grassland, scrub, wet woodland and scatted trees with one large lake and several smaller water bodies. With no or few reptiles populations recorded on site, it will be used as a receptor site for reptiles.
- *Blakehill Farm*
  Located in Wiltshire and managed by Wiltshire Wildlife Trust as a nature reserve. It is 245 ha in size and is managed as a species rich grassland. With no or few reptiles populations recorded on site, it will also be used as a receptor site for reptiles.

12.5.59 The location of the receptor sites in close proximity to the proposed GEC site can be seen in Figure 12.4.

<u>Species</u>

<u>Notable and Scarce Flora</u>

12.5.60 The clearance works will result in the loss of several notable and scarce plant species. Where possible, these plants will either be stored or translocated to the suitable receptor sites.

12.5.61 Subsequently, no notable and scarce flora will be present on site and the land will be of negligible value for flora.

12.5.62 <u>Reptiles</u>

12.5.63 In advance of the clearance works, long term reptile fencing will be erected along the working perimeter to prevent any reptiles outside of the development entering the construction site. The habitat will be maintained as unsuitable and all reptile species on site will be translocated to one of the three potential receptor sites.

12.5.64 No reptiles will be present on site, which will be considered to be of negligible value to reptiles.

<u>Amphibians - Great Crested Newts</u>

12.5.65 Prior to the commencement of any clearance works on site, the onsite population will be translocated to one of the suitable receptor sites. New water bodies will be created both within these receptor sites and within the LG Business and Logistics Park area.

12.5.66 No great crested newts will be present on site, which will be considered to be of negligible value for this species.

Water Voles

12.5.67 It was not considered possible to retain or displace the onsite water vole population, thus a full translocation programme is expected as part of the LG Development, this includes Site A which will be flooded. There will also be an extensive creation and management of new waterways throughout the local area.

12.5.68 No water voles will be present on site, which will be considered to be of negligible value for this species.

Bats

12.5.69 Although the nature conservation value of bats was considered to be less than 'local' and are therefore not considered to be a VER, they are protected by law (they are a European Protected Species and are protected under the provisions of the Habitats Directive and the Habitats Regulations) and have been recorded in the wider area. All works will be undertaken under a relevant Natural England Development Licence. The site will remain of negligible value for bats.

Brown Hare

12.5.70 There will be no measures adopted specifically for hares but the generic fencing and habitat creation in the local area is considered suitable.

12.5.71 No brown hares will be present on site, which will be considered to be of negligible value for this species.

Terrestrial Invertebrates

12.5.72 The implementation of the mitigation measures previously described and the creation of several large receptor sites comprising near identical habitats in the immediate area, act to ensure the invertebrates preferred habitats and flora are maintained and managed.

12.5.73 Understanding that the newly cleared site will be well managed and maintained under the EMMP, there will be few or no invertebrates on site. With a lack of suitable habitats, it is considered that the site will be of negligible value for these species.

Aquatic Invertebrates

12.5.74 There are no specific mitigation measures proposed. However, there are a considerable number of new water bodies due to be constructed within the local area for great crested newts, water voles and wading birds.

12.5.75 No aquatic invertebrates will be present on site, which will be considered to be of negligible value for this species.

12.5.76 *Birds*

Breeding Birds

12.5.77 Given the sites located adjacent to the Thames Estuary, much of the mitigation proposed is aimed at waterfowl or flocking species. Birds will be actively deterred from the construction site, habitat clearance works will be limited to October to February, outside the breeding bird season and there will be creation of large areas of new habitat in all of the proposed receptor sites designed to support breeding birds.

12.5.78 No breeding birds will be present on site within the future baseline. The site will therefore be considered to be of negligible value for breeding birds.

Wintering Birds

12.5.79 Once cleared and managed follow best practice methods, the site will remain of negligible value for wintering birds.

Summary

12.5.80 Following the extensive translocation of reptiles, amphibians, water voles and the habitat suitable for birds and invertebrates to various receptor areas, the GEC site will no longer support any notable or protected species.

12.5.81 The only wildlife present maybe early pioneer, weed species which are common and widespread throughout the country. As the bare earth across the GEC site offers little potential to attract any faunal species, the site will be regarded as being of negligible conservation value.

12.5.82 An extensive area of similar habitat to the north, south and west will also be cleared in preparation for the LG Development. All notable or protected species and habitats from this land will also be translocated under the same mitigation programme.

12.5.83 The existing Coryton Power Station to the east will remain operational. As such the immediate decolonisation of the area by species which have been moved off site will be difficult. The EMMP will also help manage the site to maintain it as a cleared site.

12.5.84 With the implementation of the mitigation programme and the subsequent EMMP, it is envisaged that there will be no VERs present on site under the future baseline scenario.

12.6 Potential Impacts

12.6.1 The methodology used to identify and characterise potential impacts, and assess the significance of these impacts is described in detail above (Section 12.3). In summary, this Sub-Section identifies the likely effects on Valued Ecological Receptors (VERs) from the proposed GEC scheme during the construction operational and decommissioning phases. It characterises the potential ecological impacts that are likely to arise, taking into consideration the following parameters:

- Positive / negative effects;
- Magnitude;
- Extent;
- Duration;
- Reversibility; and,
- Timing / frequency.

12.6.2 The impact assessment below (which has accounted for the mitigation implemented under the LG Development) assesses the constructional, operational and decommissioning impacts of the GEC scheme on the future baseline.

12.6.3 At this stage it is considered unnecessary to assess the potential impacts on the existing baseline as construction will only commence following the completion of the clearance and mitigation requirements under the LG Development's Consents and Permissions, subject to the relevant protected species licences being in place.

Construction

12.6.4 The construction works associated with the proposed GEC scheme could result in the following impacts to VERs:

- Permanent and temporary habitat loss;
- Direct mortality during site clearance and construction;
- Direct and indirect disturbance from construction activities including visual,

noise, dust and lighting; and

- Pollution caused by use of hazardous materials and incidental release of chemicals, fuels or waste materials.

Designated Sites

Statutory Ecological Designated Sites

12.6.5 For the purposes of this assessment, only sites which are within a 2 km radius of the proposed GEC site and those which have an obvious pathway (for example prevailing winds or connected water bodies) have been assessed, as impacts from the construction phase are not envisaged beyond this distance.

12.6.6 The GEC site is not situated within any Statutory Ecological Designated Sites. As such, it is not envisaged that there will be any direct effects on Statutory Ecological Designated Sites during the construction phase.

12.6.7 There is potential for indirect impacts resulting from elevated noise and light levels to disturb the important bird populations of the Thames Estuary and Marshes SPA (approximately 2 km to the south) and Holehaven Creek SSSI (approximately 1.5 km to the east). However, these impacts are unlikely due to the distance between the VERs and the construction site. Any increased dust or noise levels are likely to dissipate with increasing distance from the source. Accidental spillage of fuels or other pollutants are unlikely as the key pathways, the drainage ditches, are poorly connected to any sensitive sites. Furthermore accidental spillages will be managed via the EMMP and as such, significant impacts are not anticipated.

12.6.8 Given the distance between the proposed GEC site boundary and the nearest designated sites, impacts are likely to be limited and will be avoided. No impacts are predicted and therefore the GEC scheme will be of low magnitude and not significant on these VERs.

Non-Statutory Ecological Designated Sites

12.6.9 The GEC site is not within any Non-Statutory Ecological Designated Sites. As such, there will be no direct effects on any Non-Statutory Ecological Designated Sites during the construction phase.

12.6.10 Corringham Marshes SINC is located approximately 1 km north of the proposed GEC scheme, however the LG Business and Logistics Park site acts as a buffer and given the distance, any spills or contamination are likely to dissipate with increasing distance from the source. Furthermore, although pollutants, and in particular dust, can be carried off site by wind, dust tends to only affect habitats within the immediate vicinity (100 m) of a construction site (DMRB, 2009).

12.6.11 As such, any impacts are considered to be of low magnitude and not significant.

Habitats and Species

12.6.12 There will be no VERs present on the construction site, as the habitats will have been removed and the wildlife translocated or displaced through habitat clearance.

12.6.13 The construction impacts on site are therefore considered to be negligible and not significant.

12.6.14 Construction activities could impact upon VERs present in the immediate vicinity. However, as with the GEC site, the VERs initially recorded within the immediate vicinity, have been translocated off-site following the land clearance works as part of the LG Developments. The GEC site is therefore buffered by cleared land, with a negligible nature conservation value for a minimum of 100 m to south, 600 m to the north and 1.6 km to the west. The Coryton Power Station provides another buffer, reducing the potential for indirect impacts to the east. These buffers will act to further reduce any small potential impacts from increased noise, vibration, artificial lighting and general disturbance.

12.6.15 In summary, it is envisaged that the impacts from the construction phase on the local habitats and species will be of negligible magnitude and not significant.

Summary

12.6.16 It is envisaged that the any impacts will be reduced and avoided with the implementation of the EMMP and from the distance the site lies from the VERs. Subsequently, the predicted impacts will be of negligible magnitude and not significant.

Operation

12.6.17 The GEC scheme will operate continuously only shutting down for routine maintenance. Therefore noise, vibration, lighting and disturbance from the plant are envisaged 24 hrs a day, 365 days a year.

12.6.18 It is envisaged that the operation of the proposed GEC scheme, could impact upon the VERs in the area. These potential impacts include:

- Air quality effects resulting from operational emissions;
- Disturbance effects resulting from increased noise and light from the operational activities; and
- Water pollution from surface water drainage from roads, buildings and hard standing areas.

Designated Sites

Statutory Ecological Designated Sites

12.6.19 As the GEC site is not within any Statutory Ecological Designated Site, no direct impacts are envisaged. However, there is potential for indirect effects to occur. The impacts envisaged are atmospheric / water borne pollution through increased concentrations of nutrients, namely: NO_x; and, nitrogen deposition.

12.6.20 In terms of air quality effects from operational emissions, following Technical Guidance Note AGTAG 06 (Environment Agency), an assessment has been made of the predicted impacts of degraded air quality at all Natura 2000 and SSSI sites (International and National Ecological Designated Sites) within 10 km of the proposed GEC site. Under this methodology, the potential impacts upon any National Nature Reserves (NNRs) and Local Nature Reserves (LNRs) have not been assessed.

12.6.21 The surrounding SPAs and SSSIs are all designated for their ecological interest and as such maybe vulnerable to increased NO_x and nitrogen deposition. The proposed GEC scheme will increase NO_x levels across all Statutory Ecological Designated Sites for the duration of the schemes lifetime. To examine the impacts of NO_x and nitrogen deposition, the critical loads of the various Statutory Ecological Designated Sites have been identified, and the increase in deposition expressed as a percentage of the critical load. The critical load is a concentration of exposure below which there are no significant adverse effects. For the habitats supported by the SPAs and SSSIs within the study area, the critical load is 30 $\mu g/m^3$ for NO_x and varies for nitrogen deposition (between 5 and 30 kgN/ha/yr). These levels are set by the United Nations Economic Commission for Europe and the World Health Organisation.

12.6.22 For the purposes of this assessment it is assumed that any increase in concentration of greater than 1 per cent of the critical load may have a significant impact. Above this value, the likelihood of significant impacts resulting from the scheme will depend upon the current baseline levels of air pollution, the vulnerability of the site to air quality impacts, and the current conservation status (health) of the habitats within the site. Details of the air quality emissions and modelling undertaken is presented within Section 9 of this ES.

12.6.23 The proposed GEC scheme will lead to an increase in ground level concentrations of NO_x exceeding 1 per cent of the critical load over three Statutory Ecological Designated Sites. These are: Holehaven Creek SSSI; Canvey Wick SSSI; and, Thundersley Common SSSI (see Table 12.7).

12.6.24 Canvey Wick SSSI is similar, with a large predicated increase of 2.2 per cent of the critical level. However, the existing NO_x levels are well below the critical level, currently at 74.7 per cent. As such the increase in NO_x levels will not result in adverse effects on the habitats with the site. All units within this SSSI are also in a favourable condition (assessment date 23rd July 2009). Impacts are therefore also considered to be of low magnitude but not significant.

12.6.25 There is a potentially significant increase of 1.8 per cent of the critical level at Holehaven Creek SSSI. Unfortunately, at the time of publication the existing NO_x concentrations were not available for this site. We can infer some understanding of the existing concentrations by referring the NO_x levels at Canvey Wick SSSI as the two sites lie immediately adjacent to one another. The existing NO_x levels for Canvey Wick SSSI are well below that of the critical level, currently at 74.7 per cent. Therefore it has been assumed for this assessment that Holehaven Creek SSSI will be subject to similar levels of NO_x. Furthermore, each SSSI unit within Holehaven Creek is currently in a favourable condition (assessment date 15th May 2008) and is designated for their assemblage of birds rather than more susceptible grasses or other flora. It is considered reasonable to assume that an increase of 1.8 per cent would be of low magnitude, but would be not significant given the knowledge of the NO_x levels within the local area and the current conservation status of the SSSI.

12.6.26 The predicted increase in NO_x concentrations at Thundersley Great Common SSSI will be 0.31 $\mu g/m^3$ which represents a 1.0 per cent increase. The existing baseline levels of NO_x are already exceeding the critical threshold, currently standing at 103.7 per cent of the critical level. The proposed GEC scheme would thereby result in a further increase to 104.7 per cent of the critical level. The SSSI, designated for its areas of acid grassland, is described by Natural England as being in an unfavourable and recovering condition (assessment date 4th February 2009). Exact details for the reasons behind the current unfavourable condition are unclear however it can be inferred that the existing high levels of NO_x are contributing to the poor health of this site.

12.6.27 It is important to recognise however that this prediction assumes a worst case operational scenario of the plant operating at 100 per cent load for the 93 per cent of the year that the plant is available. In practice the plant is unlikely to operate for this proportion of the year and the impact is considered to be an over prediction of the true impact that will be encountered during the operation of the GEC.

12.6.28 The additional NO_x generated by the proposed GEC scheme will potentially have a significant adverse effect on the site, however this effect is considered to be of low magnitude and a worst case prediction of the likely impact.

12.6.29 The critical levels for nitrogen deposition are currently being exceeded at four of the ten statutory designated sites included within this assessment (see Table 12.9). These are: Vange and Fobbing Marshes SSSI; Northward Hill SSSI; Chattenden SSSI; and, Thundersley Great Common SSSI. Any increase in nitrogen deposition due to the GEC scheme would therefore continue to exceed the critical levels. However, the predicated increases due to the GEC scheme are all comparatively small, ranging from 0.10 per cent to 0.89 per cent of the critical load. It should be noted that the existing levels of nitrogen deposition at Thundersley Great Common SSSI are predicted to increase from approximately 306 per cent to 307 per cent above the critical load. The air quality impacts upon this designated site are likely to be contributing to the unfavourable consideration status of this SSSI, however the small increase (0.89 per cent) associated with the GEC scheme will not be distinguishable from the current high baseline levels.

12.6.30 In summary, the impacts of nitrogen deposition on the statutory sites is considered to be of low magnitude, as several sites are already exceeding the critical level, but will be not significant.

12.6.31 As such, in summary, the air quality impacts on all nationally and internationally designated sites, including the two local SPAs, are considered to be not significant. One SSSI, Thundersley Great Common SSSI could be subject to significant increases of NO_x as a result of the emissions from the GEC.

TABLE 12.7: CRITICAL LEVELS AND LOADS AT STATUTORY DESIGNATED SITES FOR NO_X

Site	*Existing NO_x Concentration ($\mu g/m^3$)*	*Critical Level of NO_x ($\mu g/m^3$)*	*Existing NO_x Concentration as % of Critical Level*	*Predicted Increase in NO_x Concentration ($\mu g/m^3$)*	*Predicted Total NO_x Concentration ($\mu g/m^3$)*	*Predicted Total Concentration as % of Critical Level*	*Predicted Increment in Concentration as % of Critical Level*
Thames Estuary and Marshes SPA and RAMSAR Site	-	30	-	0.23	-	-	0.8
Benfleet and Southend Marshes SPA and RAMSAR Site	22.9	30	76.3	0.29	23.2	77.3	1.0
Vange and Fobbing Marshes SSSI	-	30	-	0.24	-	-	0.8
Mucking Flats and Marshes SSSI	-	30	-	0.21	-	-	0.7
Holehaven Creek SSSI	-	30	-	0.53	-	-	1.8
Pitsea Marsh SSSI	24.3	30	81.0	0.21	24.5	81.7	0.7
Northward Hill SSSI	19.7	30	65.7	0.21	19.9	66.4	0.7
Canvey Wick SSSI	22.4	30	74.7	0.67	23.1	76.9	2.2
Chattensden SSSI	21.7	30	72.3	0.14	21.8	72.8	0.5
Thundersley Great Common SSSI	31.1	30	103.3	0.31	31.4	104.7	1.0

TABLE 12.8: CONTRIBUTION OF NITROGEN DEPOSITION TO CRITICAL LOADS AT THE STATUTORY DESIGNATED SITES (kg N/ha/yr)

Site	*Existing Nitrogen Deposition (kg N/ha/yr)*	*Minimum Critical Load of Nitrogen (kg N/ha/yr)*	*Existing nitrogen deposition as % of critical load*	*Predicted Increase in Deposition (kg N/ha/yr)*	*Predicted Total Deposition (kg N/ha/yr)*	*Predicted Total Deposition as % of Critical Load*	*Predicted Increment in Deposition as % of Critical Load*
Thames Estuary and Marshes SPA and RAMSAR Site	14.1	30	47.0	0.03	14.13	47.1	0.11
Benfleet and Southend Marshes SPA and RAMSAR Site	12.5	30	41.7	0.04	12.54	41.8	0.14
Vange and Fobbing Marshes SSSI	13.6	10	136.0	0.03	13.63	136.3	0.34
Mucking Flats and Marshes SSSI	13.6	30	45.3	0.03	13.63	45.4	0.10
Holehaven Creek SSSI	13.3	30	44.3	0.08	13.38	44.6	0.26
Pitsea Marsh SSSI	18.2	30	60.7	0.03	18.23	60.8	0.10
Northward Hill SSSI	30.9	10	309.0	0.03	30.93	309.3	0.31
Canvey Wick SSSI	13.3	30	44.4	0.10	13.40	44.7	0.32
Chattensden SSSI	32.1	15	214.0	0.02	32.12	214.1	0.14
Thundersley Great Common SSSI	15.3	5	306.0	0.04	15.34	306.9	0.89

12.6.32 As previously discussed, impacts from water pollution have limited potential to be washed downstream to the Statutory Ecological Designated Sites along the River Thames, as the site is well buffered on all sides and poorly connected to potential pathways. Further details on Water Quality, including the potential for water pollution, are discussed in Section 13 of this ES.

12.6.33 In addition, the risk of the any spillages will be greatly reduced with the implementation of an Operational Ecological Management Plan (OEMP). The OEMP will include a detailed pollution management strategy, targeting both wind blown and water borne impacts. Therefore, the potential impacts, in particular on the two nearby SPA sites (both east the proposed GEC site and therefore down wind) are considered to be of negligible magnitude and not significant.

12.6.34 The predicted impacts of the proposed GEC on the adjacent SPA and Ramsar sites, are considered not significant within this assessment. However, under Article 6(3) of the Habitat Directive (92/43/EEC), implemented in the UK through the Habitats Regulations (1994), the competent authority must objectively conclude that any plan or project, not directly connected with or necessary to the management of the European site will not have an adverse effect on the integrity of the site. This is commonly known as Habitat Regulations Assessment.

12.6.35 An examination of the likely effects that the proposed CCGT plant may have on the European sites has been undertaken. It is acknowledged that this report provides a different level of detail than that typically required under a formal Habitat Regulations Assessment Screening Assessment. However, it is likely that any formal Screening Assessment would mirror the conclusions made within this assessment.

Non-Statutory Ecological Designated Sites

12.6.36 For Non-Statutory Ecological Designated Sites the impacts are also envisaged to result from atmospheric NO_x and nitrogen deposition. Although there is no statutory requirement to assess the impact on these sites, the critical levels for the local Statutory Ecological Designated Sites has been adopted.

12.6.37 As mentioned above for the Statutory Ecological Designated Sites, it is not anticipated that the proposed GEC scheme will contribute more than 1 per cent of the critical levels for nitrogen deposition. Furthermore, the increases in NO_x levels for Statutory Ecological Designated Sites above the critical load are located down wind to the east of the proposed GEC site. As such, the increases in NO_x at the two Non-Statutory Ecological Designated Sites, both located to the north and west, are not expected to exceed the 1 per cent threshold of significance and will therefore remain not significant.

Habitats and Species

12.6.38 There will be no VERs on site as the habitats will have been removed and, therefore, the wildlife is limited to a few common colonising species. The operational impacts on site are therefore considered to be negligible and not significant.

12.6.39 All VERs recorded in close proximity to the proposed GEC site will also have been translocated as part of the land clearance works for the LG Development. The GEC site will therefore be buffered by cleared land and the Coryton Power Station, all with a negligible nature conservation value.

12.6.40 However, given the proximity of the LG Development Receptor Sites, it is possible some species may move back to the GEC site and re-colonise in the surrounding habitats during the 35 year operational lifetime of GEC. If any species are recorded on site during the lifetime of the scheme, they will have returned and colonised during its operational phase and will therefore be habituated its associated disturbances. The impacts, due to the operation phase of the GEC scheme must therefore be considered not significant.

12.6.41 Depending on the location of, and connectivity between any new water bodies on site and in the immediate area, water voles and great crested newts could move back. Both species are mobile and can travel to avoid high levels of disturbance. Their presence will not require any changes to the operation of the CCGT plant but could necessitate the need for seasonal and sensitive management of the site.

12.6.42 The GEC site is located on land within the LG Development, more specifically on land within the south east corner of the LG Business and Logistics Park and, therefore, will subsequently be buffered by hardstanding and built structures interspersed with well managed grassland amenity planting to the north, east and west. As such, suitable habitats are unlikely to be present on site. The recolonisation of notable or scarce flora, brown hare and notable or protected terrestrial and aquatic invertebrates will therefore be unlikely.

12.6.43 The majority of all reptiles translocated off-site will have been taken to the two receptor sites in Wiltshire. Any recolonisation must therefore occur from a remnant local population. Little additional management, beyond the sensitive timing and completion of grass strimming will be required.

12.6.44 Breeding birds are the most likely VER to move back on to site as they are highly mobile species and can readily habituate to increases in light, noise and movement for example. The presence of breeding birds on site will only be of importance if newly proposed works threaten to disturb their nests during the breeding bird season.

<u>Summary</u>

12.6.45 A summary of the predicated impacts on the VERs is provided in Table 12.9.

TABLE 12.9: SUMMARY OF THE IMPACTS FROM THE OPERATIONAL PHASE OF THE PROPOSED CCGT SCHEME ON THE EXISTING BASELINE WITHOUT MITIGATION

VER	***Impact***	***Magnitude***	***Significance***
Statutory Designated Sites	NO_x	Low	Significant Adverse (national)
	Nitrogen Deposition	Low	Not Significant
Non-Statutory Designated Sites	NO_x	Low	Not Significant
	Nitrogen Deposition	Low	Not Significant
Habitats and Species	Air Pollution	Negligible	Not Significant
	Disturbance	Negligible	Not Significant

Decommissioning

12.6.46 It is envisaged that GEC will be closed and demolished following its designed life period of 35 years. At this time, GEC will be demolished, stripped and removed off site following best practice methodologies. The decommissioning will take approximately three years. At this time, the GEC site will be completely cleared and returned to a clean ‘Brownfield’ site. Any potential impacts to ecology and nature conservation during this period are similar to those described above for construction.

12.6.47 It is currently anticipated that the decommissioning will be undertaken within and around the operational LG Development. The GEC site itself is likely to be void of any protected or notable species. However, the landscaping and mitigation measures in the immediate vicinity, completed as part of the LG Development will have matured and may have encouraged the return of several species, such as water voles or breeding birds. Disturbance from dust and vibration are likely to increase temporarily as is the potential for pollution from hazardous materials but will be limited through an appropriate EMMP.

12.6.48 Overall, it is envisaged that update surveys will be required but the decommissioning will be potentially beneficial, particularly on the Statutory Ecological Designated Sites and the Non-Statutory Ecological Designated Sites as air quality will improve marginally and as the site will be transformed from an operational Power Station and hardstanding to a derelict Brownfield site.

12.6.49 The decommissioning therefore offers a range of opportunities for habitat creation and enhancement. Impacts are therefore predicted to be of low magnitude and not significant.

12.7 Mitigation Measures and Monitoring Programmes

12.7.1 Within the context of an Ecological Environmental Impact Assessment, mitigation measures comprise a hierarchy of measures that can be undertaken to prevent or reduce adverse impacts. The hierarchy of measures include:

- Avoidance / Prevention:
  These are measures taken to avoid or prevent adverse impacts, e.g. scheme layout; timing of site works;
- Reduction / Mitigation:
  These are measures taken to reduce adverse impacts, e.g. retaining walls; pollution interceptors; and
- Compensation / Offsetting:
  These are measures taken to offset significant residual adverse impacts, i.e. those that cannot be entirely avoided or mitigated to the point that they become insignificant. For example, compensation / offsetting measures include habitat creation / enhancement.

12.7.2 Avoidance / Prevention of adverse impacts are the primary aim of ecological mitigation. Where this is not possible Reduction / Mitigation measures are proposed to reduce adverse impacts. Where this is not possible Compensation / Offsetting then measures to offset the adverse impact would be included in the mitigation strategy.

12.7.3 In this Sub-Section, specific mitigation measures are proposed for all potential significant ecological impacts on the habitats and species identified in the preceding Sections. Generic mitigation measures are also proposed and include Best Practice Methods and general principles that can be applied to the proposed GEC scheme as a whole, and are relevant to all habitats and species.

12.7.4 Mitigation and management measures, implemented as part of the LG Development, have already been outlined in Section 12.4. The relationship between the LG Business and Logistics Park Ecological Management and Mitigation Plan (EMMP) and any EMMP prepared for GEC should be established to ensure that any requirements within the GEC site set by the LG Business and Logistics Park EMMP can be delivered. Establishing the relationship between the GEC EMMP and the LG Business and Logistics Park EMMP will also ensure opportunities for co-ordination between the two EMMPs are identified and exploited.

12.7.5 The following suggested mitigation measures are put forward to reduce the predicted impacts that are due to the construction and operation of GEC alone.

Construction

Designated Sites

Statutory Designated Sites

12.7.6 As there will be no significant impacts on Statutory Ecological Designated Sites, no mitigation measures are proposed.

12.7.7 Therefore, the impacts will remain as negligible magnitude and not significant.

Non-Statutory Designated Sites

12.7.8 The distance from the construction site and implementation of the EMMP will ensure that no significant adverse effects from pollution events will occur at Non-Statutory Ecological Designated Sites

12.7.9 Therefore, the impacts will be of negligible magnitude and not significant.

Habitats and Species

12.7.10 As there will be no significant impacts on any habitats or species no mitigation measures are proposed.

12.7.11 Therefore, the impacts will remain of negligible magnitude and not significant.

Operation

Designated Sites

Statutory Designated Sites

12.7.12 Although measures to minimise atmospheric pollution are included within the design of GEC, it has been predicted that there will be a significant adverse impact during the operational phase on Thundersley Great Common SSSIs. It is important to recognise however that this prediction assumes a worst case operational scenario of the plant operating at 100 per cent load for the 93 per cent of the year that the plant is available. In practice the plant is unlikely to operate for this proportion of the year and the impact is considered to be an over prediction of the true impact that will be encountered during the operation of the GEC. As such no mitigation is proposed for this impact though GEC propose an on going dialogue with regard to impacts to this receptor with the relevant authorities.

Non-Statutory Designated Sites

12.7.13 No significant adverse impacts are anticipated during the operational phase on non-statutory designated sites. As such, no specific mitigations measures are provided.

12.7.14 The height of the stacks will ensure that levels of deposition will dissipate. Mitigation provided for other VERs (such as landscaping) will help to further reduce the effects of the predicted slight increase in air pollution, noise and disturbance on the two non-statutory sites.

All Habitats and Species

12.7.15 As there will be no significant impacts on any habitats or species no mitigation measures are proposed.

12.7.16 The implementation of the Operational Environmental Management Plan (OEMP) will further ensure accidental spillages and unnecessary disturbance are avoided.

12.7.17 Therefore, the impacts will remain as negligible magnitude and not significant.

12.7.18 In addition, there is considerable opportunity to provide biodiversity enhancement as part of the landscaping works for the GEC site. PPS9 and the Natural Environment and Communities Act (1981) both place responsibilities on developers, Statutory Bodies and Local Authorities to deliver ecological enhancements within new development. Mitigation and enhancement work has already been provided as part of the wider LG Development and therefore any landscaping and mitigation provided within the GEC site would be considered a direct enhancement in comparison with the baseline against which the impacts of GEC have been assessed.

12.7.19 The following recommendations should be considered in the detailed design of landscaping for the site.

- Additional ponds could be provided on site. These could be designed in particular for amphibians and aquatic invertebrates but would also provide value for a variety of bird species. It is understood that a large number of ponds will be provided as part of mitigation and enhancement for the wider LG Business and Logistics Park development. Therefore any ponds provided would compliment this mitigation.

- Grassland surrounding the GEC could be planted with a locally appropriate species-rich grass seed mix. In particular, areas could be designed to incorporate a number of the nationally notable species recorded within the wider LG Business and Logistics Park area, such as divided sedge, broad-leaved spurge and dittander. Any such enhancement would need to carefully consider the soil and hydrology of the developed site and be designed appropriately. The incorporation of the above species, for example, would not be appropriate in areas where the drainage has been significantly improved. The creation of grassland areas would also be of benefit to terrestrial invertebrate species and would also provide habitat for reptiles and amphibians should any re-colonisation of the area take place from adjacent habitats.
- Landscape planting, in particular any screen planting would provide new habitat for nesting birds and terrestrial invertebrate species as well as providing new features of value to foraging and commuting bats. Bird nesting boxes could also be provided on buildings within the area to immediately increase the availability of nesting habitat on site.
- The OEMP produced could also include prescriptions relevant to the management of habitats within the site to maximise their value to wildlife. This could include low frequency, ecologically sensitive grass cutting to allow grass and flora species to flower and set seed. The OEMP should also include recommendations for the management of drainage features and any ponds provided on site. Consideration should be given to the potential for habitats to be re-colonised by species such as water voles, reptiles and great crested newt, and advice provided accordingly to ensure that offences under the Habitats Regulations (1994) and the Wildlife and Countryside Act (1981) are not committed in the process of undertaking routine management. This may require an element of ecological monitoring across the site during the operational phase.

12.7.20 Any or all of the above measures would enhance the value of the GEC site for biodiversity. The operational noise, vibration and disturbance resulting from the GEC site may depress the potential value of the surrounding habitats for wildlife.

12.7.21 However, many wildlife species are known to habituate to relatively high levels of baseline disturbance, and as such wildlife would be anticipated to re-colonise suitable habitats within the site over time.

12.7.22 Formal assessment of these measures has not been made as they have not yet been agreed.

12.8 Assessment of Residual Impacts

12.8.1 Table 12.10 shows the residual impacts of the proposed GEC scheme once the mitigation measures have been put in place.

TABLE 12.10: RESIDUAL EFFECTS ON ALL VERS

VER	*Phase*	*Impact*	*Magnitude*	*Residual Significance*
Statutory Designated Sites	Construction	Disturbance / Pollution	Negligible	Not Significant
	Operation	Air Pollution	Low	Not Significant
Non-Statutory Designated Sites	Construction	Disturbance / Pollution	Negligible	Not Significant
	Operation	Air Pollution	Low	Not Significant
Habitats and Species	Construction	Habitat Loss / Disturbance / Pollution	Negligible	Not Significant
	Operation	Air Pollution	Negligible	Not Significant

12.9 Assessment of Cumulative Impacts

12.9.1 The known permitted developments within close proximity of the GEC site are the London Gateway Port / London Gateway Business and Logistics Park (collectively called the LG Development). The LG Development is, located to the north, west and south of the GEC site. The LG Development created the need for an extensive redevelopment of the local road structure including works to the existing A13.

12.9.2 The cumulative impact of the development of GEC and the LG Development would result in impacts of high magnitude with significant adverse effects on a number of VERs. However, the creation of several large receptor sites and the other associated mitigation measures, currently being implemented across the wider LG Development area, have been specifically designed to reduce and compensate for the cumulative impacts derived from the LG Development thereby reducing the impact of the LG Development to insignificant.

12.9.3 Therefore, whilst without mitigation the cumulative impacts from the development of GEC and the LG Development would cause wide ranging and significant impacts, a considerable mitigation package, which is already in place, will reduce any potential cumulative impacts to not significant. With the mitigation measures already in place and those proposed as part of this development, the cumulative impacts on the local nature conservation value is considered to be not significant.

12.10 References

Anon. (1981). The Wildlife and Countryside Act. HMSO, London

BTO. Available at http://blx1.bto.org/birdfacts/helptexts/population.htm Visited on the 23rd November 2009

DMRB, 2009. Available at http://www.standardsforhighways.co.uk/dmrb/vol11/index.htm Visited on the 11th November 2009.

Fuller R. J. (1980) A Method for Assessing the Ornithological Interest of Sites for Conservation. Biological Conservation. 17; 229-239.

IEEM (2006) Guidelines for Ecological Impact Assessment in the UK. IEEM Winchester

JNCC (2003) Handbook for Phase 1 habitat survey: A technique for environment audit. Joint Nature Conservancy Committee, Peterborough.

MAGIC database. Available at http://www.magic.gov.uk/website/magic/ Accessed on 4thth November 2009

National Biodiversity Network (NBN) database. Available at http://www.nbn.org.uk/ Accessed on 3rd November 2009

Nature on the Map. Available at http://www.natureonthemap.org.uk/ Accessed on 4th November 2009.

P&O and Shell (2004) The (London Gateway Logistic and Commercial Centre) Outline Planning Application 2002, Environmental Statement Chapter 18. London Gateway.

P&O (2004) The (London Gateway Port) Harbour Empowerment Order 2002. Environmental Statement illustrations Volume III (Bird data). London Gateway.

Thomson Ecology (3) (2008) Bat Activity Survey Interim Report – 2nd Visit. Thomson Ecology for DP World.

Thomson Ecology (4) (2008) Phase 1 Habitat Survey Figures. Thomson Ecology for DP World.

Thomson Ecology (9) (2008) Natural England Water Vole Trapping and Translocation Licence Method Statement (Site A). Thomson Ecology for DP World.

Thomson Ecology (12) (2008) Freshwater Invertebrate Survey 2008. Thomson Ecology for DP World.

Thomson Ecology (14) (2008) Great Crested Newt Survey. Thomson Ecology for DP World.

Thurrock Biodiversity Action. Available at http://www.thurrock.gov.uk/countryside/pdf/biodiversity_action_2007.pdf Visited on the 23rd November 2009.

SECTION 13

WATER QUALITY

13 WATER QUALITY

13.1 Summary

13.1.1 During construction, the supply of water for GEC will be the responsibility of the Construction Contractor. It is expected that the water source will be the towns water supply. The discharge of any effluents, including site drainage, will also be the responsibility of the Construction Contractor, who will be required by GECL to reach agreement with the Environment Agency (EA) and the local sewerage undertakers with regard to the detailed methods of disposal. The conditions for any discharge to the sewer will be set out in a separate trade effluent discharge licence.

13.1.2 During operation, water will only be required on a day-to-day basis for make-up to the HRSG system. In addition, the process effluents produced by GEC in any significant quantity will be the water treatment plant effluent and the blowdown from the HRSG's. Small quantities of blowdown will be discharged in order to avoid the build-up of impurities in the water for the HRSGs. This discharge is virtually pure water, containing very small quantities of various chemicals that are used to prevent corrosion and scaling. The blowdown will be discharged to the wider drainage system. GECL will consider the recovery and re-use of blowdown during the final design stage.

13.1.3 The water treatment plant effluent will consist of a concentrated solution of the impurities present in the raw water and will discharge to the wider drainage system.

13.1.4 The quality of the effluent to be discharged from GEC will be monitored. At present, it is expected that the following will be monitored: flow; suspended solids; oil; pH; and, temperature. These discharges will be controlled to limits set by the EA in any future Environmental Permit under the Environmental Permitting (England and Wales) Regulations 2007. GEC will include an on-site Sewage Treatment Plant that will treat domestic effluents prior to discharge to the wider drainage system.

13.1.5 Any areas of the GEC site that are likely to be contaminated with oil will drain to oil interceptor(s) to limit visible oil in the water. This surface water, with waters from non-contaminated areas, will drain to the wider drainage system.

13.1.6 However, employment of standard good working practices, as set out in this Section, should ensure that any impacts due to the water discharging from the GEC site would be insignificant.

13.2 Introduction

13.2.1 This Section considers water use at GEC and the disposal of its aqueous effluents.

13.3 Key Planning Policies

13.3.1 Section 3 provides the planning policy content. The policies listed below have informed the assessment process, to which reference has been made in Section 3. A full transcript of these policies is contained in Volume 2 Appendix A.

<u>East of England Plan</u>

SS9	The Coast
WAT1	Water Efficiency
WAT2	Water Infrastructure
WAT4	Flood Risk Management

13.4 Assessment Methodology and Significance Criteria

Assessment Methodology

13.4.1 The various aspects of the water requirement for GEC have been considered.

13.4.2 Sources of the raw water were identified based on the most likely source of raw water with appropriate processing and storage methods were defined, based on the intended uses.

13.4.3 The assessment covered all major activities and processes that will generate aqueous effluents. These are discussed in detail later in this Section. The reason for use and the amounts of water required have been specified and, where appropriate, the anticipated effluent compositions established.

13.4.4 The likely mitigation measures are identified. GEC will be engineered to adhere to the standards and limits set by the Environment Agency in any future Environmental Permit under the Environmental Permitting (England and Wales) Regulations 2007 for GEC.

Significance Criteria

13.4.5 The significance criteria of the potential / likely impacts of GEC on water quality are defined as:

High: Large/ long-term change to the water quality;

Moderate: Small / short-term change to the water quality; and

Insignificant: No perceivable impact.

13.5 Baseline Conditions and Receptors

13.5.1 The GEC site, approximately 29.1 hectares (71.9 acres) in size including temporary laydown, is situated on the north bank of the Thames Estuary and lies approximately 6 km east of the A13 Road. The A1014 dual carriageway (The Manorway) lies approximately 0.5 km to the north of the site and runs east to west to provide a link with the A13, which in turn links in with the M25 at Junction 30.

13.5.2 The nearest settlements are at Corringham and Fobbing which lies approximately 4 km to the west, Canvey Island which lies approximately 5 km to the east and Basildon which lies approximately 7 km to the north.

13.5.3 To the east of the GEC site lies the existing 800 MWe CCGT Power Station owned and operated by Coryton Energy Company Limited (CECL Power Station) (700 m east) and the existing Coryton Oil Refinery (950 m east) owned and operated by Petroplus.

13.5.4 The main watercourse in the vicinity of the site is the estuary of the River Thames, a large, tidally influenced river which lies approximately 200 m south of the southern site boundary (see Figure 1.1). The Thames is approximately 215 miles long. It originates near Cirencester in the Cotswolds and flows east through London and past the southern boundary of the CCGT site, before discharging into the North Sea, approximately 15 km east of the site.

13.5.5 EA Indicative Flood Maps indicate that the entire site is located in Flood Zone 3a. Developments in this classification are described as being "*at risk of flooding if flood defences are not present*". Land in this zone is assessed as having a 1 in 100 or greater annual probability of river flooding (> 1%) or a 1 in 200 or greater (> 0.5%) annual probability of flooding from the sea. The EA flood map also indicates that the site is offered protection from flood existing flood defences.

13.5.6 Data from the EA and Thurrock Council indicates that the flood defences were constructed to protect the area from a tidal flood event with an annual occurrence probability of 0.1%, i.e. a 1 in 1000 year event.

13.5.7 Flood Risk is discussed further in the Flood Risk Assessment (FRA) for GEC, included in Volume 2, Appendix D.

13.6 Potential Impacts

Construction

13.6.1 A small amount of water will be required each day for the general construction works.

13.6.2 At present, it is envisaged that this will be taken from the towns water supply.

13.6.3 Several construction activities could require the disposal of water from the GEC site, such as washing facilities and run off from hardstanding.

13.6.4 GECL will require its Construction Contractors to reach agreement with the Environment Agency and, if necessary, the local sewerage undertakers with regard to the detailed methods of disposal. The conditions for any discharge to the sewer will be set out in a separate trade effluent discharge licence.

13.6.5 Chemical and Petroleum Storage tanks on the GEC site will be situated within a bund for prevention of releases to the environment and sized to hold 110 per cent of the tank contents. Maintenance of construction machinery which could result in a release of oil will not be allowed on the GEC site, which will help to prevent the accidental leakage of lubricating and hydraulic fluids.

Operation

13.6.6 At present, it is envisaged that all water required by GEC during operation will be taken from the towns water supply.

13.6.7 During normal operation of GEC, water will only be required on a day-to-day basis for make-up to the HRSG system and for domestic / sanitary purposes.

13.6.8 This water must be of high purity and will be treated in a water treatment plant on the GEC site. Together with the miscellaneous minor process requirement of 5 m^3/day, the total quantity of water required by GEC will be of the order of 500 m^3 per day.

13.6.9 Raw water will be stored on site in a raw water storage tank. The lower portion of this tank is dedicated to fire water storage and will supply the fire fighting system. The upper part of the water tank is used to supply the water treatment plant, in addition to supplying water for on site domestic purposes.

13.6.10 Demineralised water from the water treatment plant is stored in an above ground storage tank.

13.6.11 At the detailed design stage of GEC, consideration will be given to the incorporation of rainwater harvesting. This rain water harvesting will reduce water consumption from other sources, adding to the sustainability of the project.

13.6.12 Intermittent process effluents comprise gas turbine wash water and very rarely facility wash down. These effluents are generated in very small quantities and would be tankered off site as they may contain detergents.

<u>Effluent Discharge</u>

13.6.13 Indicative process effluents from GEC will comprise the following:

Boiler Blowdown	Before flashing-off to atmosphere	456 m^3/day
	After flashing-off to atmosphere	338 m^3/day
Water Treatment Plant Effluent		150 m^3/day
Miscellaneous Minor Process Effluents		5 m^3/day

13.6.14 The blowdown will be discharged to the wider drainage system. GECL will consider the recovery and reuse of the blowdown during the final design stage.

13.6.15 The quality of the effluent from GEC will be monitored. It is expected that the following parameters will be monitored: flow; suspended solids; oil; pH; and temperature.

13.6.16 These discharges will be controlled to the limits set by the EA in Environmental Permit under the Environmental Permitting (England and Wales) Regulations 2007. The conditions for any discharge to the sewer will be set out in a separate trade effluent discharge licence.

13.6.17 The surface water from any areas of the GEC site that are likely to be contaminated with oil will drain to oil interceptor(s) to limit the oil in water content to a level regulated by the Environmental Permit normally with a limit of “no visible oil” quoted (normally below 10 ppm) before discharge to the wider drainage system. Surface water from areas unlikely to be contaminated with oil will discharge, untreated to the wider drainage system. This will be typical run-off from roads and hardstanding.

Boiler Water

13.6.18 The HRSG system (containing boiler water / steam / condensate) has losses from its recycled water due to some deliberate blowdown to maintain the correct chemical control. The water required to make up these losses must be of high purity and may be treated in a water treatment plant.

13.6.19 Although of high purity, the feed-water entering the HRSGs will contain small amounts of impurities. As the water in the boiler is evaporated the impurities become concentrated in the boiler water system. To ensure that these impurities do not cause corrosion or scaling of the boiler heat transfer surfaces, treatment chemicals will be added to the boiler.

13.6.20 In addition, the concentration of the impurities is controlled by discharging some of the water, either continuously or intermittently. This water is the “blowdown”. The blowdown water is replaced by fresh, treated water added to the circuit. The water will be dosed with treatment chemicals in order to control corrosion. As the feed-water will be of high purity the quantity of blowdown discharged will be small, of the order of 456 m^3/day. The blowdown is discharged at HRSG temperature and pressure to a blowdown vessel where some of the blowdown is evaporated off prior to the release of the cooled remainder to the storm drains.

13.6.21 Some of the blowdown flashes off to steam in the blowdown vessel thus reducing the volume still further to about 338 m^3/day. A majority of this blowdown could be reused by recycling through the water treatment plant. It is virtually pure water containing very small quantities of various corrosion and scaling prevention chemicals, for example: ammonia; phosphate; and, suspended solids). Any blowdown water discharged would be tested for the parameters prescribed in the Environmental Permit prior to release to the wider drainage system.

13.6.22 A typical analysis of the boiler blowdown is:

Conductivity:	50 μS/cm
pH:	10
Ammonia as NH_3:	1 mg/L
Phosphate as PO_4:	5 mg/L

The Water Treatment Plant

13.6.23 The Water Treatment Plant will provide the demineralised make-up water that will be required for GEC.

13.6.24 Any effluent produced at the water treatment plant will be discharged to the site drainage system in small enough quantities that it would have an insignificant environmental impact.

Site Drainage

13.6.25 There will be three new drainage systems on GEC site:

- The surface water drainage system;
- The oily water drainage system;
- The contaminated wastewater system (i.e. purge water from the cooling water system and water treatment plant effluent); and
- The on site sewerage system.

Surface Water Drainage System

13.6.26 The surface water drainage system will drain areas of the GEC site unlikely to be contaminated with oil and discharge the water to the wider drainage system. The majority of the surface water drainage will be uncontaminated and typical of surface water run off from areas of hardstanding and roads, nevertheless water will pass through oil interceptors to ensure that no contaminated waters are release from the site.

13.6.27 GEC will not lead to significant quantities of surface water run off as the drainage system will be designed by the contractor so as to avoid this through slow release of storm waters and the use of oil interceptors.

Oily Water Drainage System

13.6.28 The oily waste water drainage system will drain all areas of the GEC site where oil spillages could occur. The design will incorporate oil interceptors and traps. This will discharge with the other surface water discharge to the wider drainage system. The discharge from each oil interceptor will contain no visible oil or grease.

13.6.29 The areas liable to oil spillage are:

- The electrical transformers (which may contain insulating oil, if so this will be polychlorinated biphenyl (PCB) free);
- The areas surrounding the bunded lubricating oil storage tanks (the bunds themselves will not have any drainage connections); and
- Any car parking areas.

13.6.30 Adequate facilities for the inspection and maintenance of oil interceptors will be provided and the interceptors will be emptied as necessary and desludged to ensure efficient operation. A qualified contractor will dispose of the sludge off-site.

On Site Sewerage System

13.6.31 Any sewage associated with GEC will be piped to the Sewage Treatment Plant.

13.6.32 All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.

Miscellaneous Discharges

13.6.33 Occasionally it will be necessary to wash the blades of the air compressor section of the gas turbines to remove debris that has penetrated the inlet air filters and become lodged on the compressor blades. This will be done at times when the performance of the gas turbines has degraded and will depend upon the air quality in the vicinity of the GEC site.

13.6.34 Washing can be done in two ways, either by:

- On-line washing where a fine spray of water is allowed to pass through the gas turbine; or,
- Off-line washing where the compressor blades are rotated slowly through a detergent solution.

13.6.35 In the case of off line washing approximately 15 m^3 per CCGT unit of waste water containing detergent will be retained on-site in a storage tank and subsequently tankered off-site by a licensed contractor for disposal at an appropriately licensed disposal facility.

13.6.36 Flue gas side washing is not anticipated. However, during commissioning and at infrequent intervals during the life of GEC it will be necessary to chemically clean the water side of the HRSG tubes. All effluents will be tankered off site by a licensed contractor for treatment and disposal at an appropriately licensed disposal facility.

13.6.37 During maintenance it may be necessary to drain down the HRSG, the closed circuit cooling water system or parts of these systems. All will be discharged to the wider drainage system. The HRSG water will be high purity water containing traces of ammonia, phosphate and suspended solids. The closed circuit cooling water will be high purity water containing small amounts of corrosion inhibitor (probably nitrite / borate). During the detailed engineering stage, consideration will be given to the storage, recovery and reuse of these effluents to further minimise the impact of the plant.

13.6.38 Sample points will be provided on the outlet of the oil separators, and in any drains at the GEC site prior to discharge.

13.6.39 No prescribed substances, as described in the Environmental Permitting (England and Wales) Regulations 2007, are generated or used on the GEC site.

13.7 Mitigating Measures and Monitoring Programmes

Construction

13.7.1 The British Standard Code of Practice for Earthworks BS 6031:1981 contains detailed methods that should be considered for the general control of drainage on construction sites. Further advice is also available in the British Standard Code of Practice for Foundations BS 8004: 1986. These will be taken into account in the design and construction of GEC.

13.7.2 Mitigation measures during construction will include, as appropriate:

- Any oil storage tanks to be located on an impervious base provided with bund walls to give a containment capacity of at least 110 per cent of the tank volume. All valves and couplings to be contained within the bunded area.
- Any surface water contaminated by hydrocarbons, which are used during the construction phase, to be passed through oil / grit interceptor(s) prior to discharge.
- Measures will be taken to ensure that no leachate or any surface water that has the potential to be contaminated is allowed to enter directly or indirectly into any water course, underground strata or adjoining land. These will include concrete gullies, dewatering ponds and other similar measures.
- Provisions to be made so that all existing drainage systems continue to operate. These will include visual inspections and corrective measures as appropriate.
- Water inflows to excavated areas to be minimised by the use of lining materials, good housekeeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water.

Site personnel to be made aware of the potential impact on ground and surface water associated with certain aspects of the construction works to further reduce the incidence of accidental impacts.

- Refuelling of construction vehicles and equipment to be restricted to a designated area with properly designed fuel tanks and bunds and proper operating procedures.

Operation

13.7.3 The EA will set limits on the quality of water that is discharged from the GEC site under the Environmental Permit. The GEC will include an on-site Sewage Treatment Plant that will treat domestic effluents prior to discharge to the wider drainage system.

13.7.4 All aqueous process effluents will be discharged to the wider drainage system and will be in accordance with limits set by the EA in the Environmental Permit.

13.7.5 No further on-site treatment will be necessary. This represents the best practicable environmental option for these effluents and is consistent with the approach suggested in Chapter 2 of the EA's PPC Combustion Sector Guidance Note V2.03.

13.7.6 The Water Treatment Plant effluent will be monitored for pH value. If the pH is out with the limit of 6 to 9, or outside any limit permitted by the EA, the discharge will stop until the failure is corrected.

13.7.7 The use of anti-icing substances will be minimised during the winter.

13.7.8 All oil and chemical storage tanks and areas where drums are stored will be surrounded by an impermeable bund. Single tanks will be within bunds sized to contain 110 per cent of capacity and multiple tanks or drums will be within bunds sized to contain 110 per cent of the capacity of the largest tank. Permanently fixed taps, filler pipes, pumping equipment, vents and piping will be located through the wall of the bund with normally locked valves. After inspection of the water accumulated in the bunds the valves will be unlocked and opened allowing the accumulated water to flow from the bund.

13.7.9 Taps and valves will be designed to discharge downwards and will be shut and locked in that position. Manually started electrically operated pumps will remove surface water collected within the bund and its composition will be verified through appropriate analysis prior to disposal.

13.7.10 The surface water drainage system will drain areas of the GEC site unlikely to be contaminated with oil due to their location and discharge the water to the storm water drainage system. The majority of the surface water drainage will be uncontaminated and typical of surface water run off from paved areas or roads. The potential for contamination is minimal and associated with areas around storage vessels which will be appropriately bunded.

13.7.11 An oily waste water drainage system will drain all areas where oil spillages could occur. The design will incorporate oil interceptors and traps. These will discharge with the other surface water discharge to the storm water discharge system. The discharge from each oil interceptor will contain no visible oil or grease.

13.7.12 Adequate facilities for the inspection and maintenance of oil interceptors will be provided and the interceptors will be emptied as necessary and desludged to ensure efficient operation. A qualified contractor will dispose of the sludge off-site.

13.7.13 All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.

Flood Risk

13.7.14 GEC will be designed to take into account the flood risks associated with the site which is discussed in detail in the FRA included in Volume 2, Appendix D and summarised in this Section of the ES.

13.7.15 The proposed GEC site is located on the banks of the River Thames, near Coryton in Thurrock within the boundaries of the London Gateway Port / London Gateway Logistics Park development.

13.7.16 A Level 3 FRA has already been undertaken for the LG Development as a whole which identified flood risks and mitigation measures for the wider development.

13.7.17 The FRA for GEC indicates that the GEC site is at risk from tidal flooding from the Thames Estuary, particularly from storm surge tides. However the site is currently protected by flood defences which offer adequate protection for the site from both a 1 in 200 and 1 in 1,000 year flood event. The FRA found that the new dock and quay wall that will be constructed as part of the LG Development if constructed would provide extra protection to the site, beyond the predicted 1 in 1,000 year flood event throughout the lifespan of GEC, even when taking into consideration the affects of climate change.

13.7.18 Given the flood defences that already exist the risk posed to the GEC site by tidal inundation is considered to be negligible. In addition, the site is not considered to be at risk from any fluvial sources.

13.7.19 During the detailed design stage, the potential for raising of site levels, access roads and floor levels in critical areas of the plant to provide further protection to the GEC will be investigated with a view to allowing safe evacuation, even in the unlikely event of a breach of the defences or from overland flow from adjacent sites.

13.7.20 Detailed hydrodynamic modelling has not been undertaken specifically for the GEC site. However, hydrodynamic models undertaken for the larger Thames Haven Redevelopment have been studied to assess the risk to the site following a breach in flood defences. Results of the modelling exercise have confirmed that any risk to the site, even after a breach in flood defences would be negligible, particularly if site levels and floor levels were raised.

13.7.21 Notwithstanding the above, the GEC development has also been shown to pass both the sequential and exception tests.

13.8 Assessment of Residual Effects

Construction

13.8.1 The British Standard Code of Practice for Earthworks BS 6031:1981 contains detailed methods that should be considered for the general control of drainage on construction sites. Further advice is also available in the British Standard Code of Practice for Foundations BS 8004: 1986. These will be taken into account in the design and construction of GEC.

13.8.2 Mitigation measures during construction will include, as appropriate:

- Any oil storage tanks to be located on an impervious base provided with bund walls to give a containment capacity of at least 110 per cent of the tank volume. All valves and couplings to be contained within the bunded area.
- Any surface water contaminated by hydrocarbons, which are used during the construction phase, to be passed through oil / grit interceptor(s) prior to discharge.
- Measures will be taken to ensure that no leachate or any surface water that has the potential to be contaminated is allowed to enter directly or indirectly into any

water course, underground strata or adjoining land. These will include concrete gullies, dewatering ponds and other similar measures.

- Provisions to be made so that all existing drainage systems continue to operate. These will include visual inspections and corrective measures as appropriate.
- Water inflows to excavated areas to be minimised by the use of lining materials, good housekeeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water. Site personnel to be made aware of the potential impact on ground and surface water associated with certain aspects of the construction works to further reduce the incidence of accidental impacts.
- Refuelling of construction vehicles and equipment to be restricted to a designated area with properly designed fuel tanks and bunds and proper operating procedures.

Operation

13.8.3 The EA will set limits on the quality of water that is discharged from the GEC site under the Environmental Permit. The GEC will include an on-site Sewage Treatment Plant that will treat domestic effluents prior to discharge to the wider drainage system.

13.8.4 All aqueous process effluents will be discharged to the wider drainage system of the and will be in accordance with limits set by the EA in the Environmental Permit.

13.8.5 No further on-site treatment will be necessary. This represents the best practicable environmental option for these effluents and is consistent with the approach suggested in Chapter 2 of the EA's PPC Combustion Sector Guidance Note V2.03.

13.8.6 The Water Treatment Plant effluent will be monitored for pH value. If the pH is out with the limit of 6 to 9, or outside any limit permitted by the EA, the discharge will stop until the failure is corrected.

13.8.7 The use of anti-icing substances will be minimised during the winter.

13.8.8 All oil and chemical storage tanks and areas where drums are stored will be surrounded by an impermeable bund. Single tanks will be within bunds sized to contain 110 per cent of capacity and multiple tanks or drums will be within bunds sized to contain 110 per cent of the capacity of the largest tank. Permanently fixed taps, filler pipes, pumping equipment, vents and piping will be located through the wall of the bund with normally locked valves. After inspection of the water accumulated in the bunds the valves will be unlocked and opened allowing the accumulated water to flow from the bund.

13.8.9 Taps and valves will be designed to discharge downwards and will be shut and locked in that position. Manually started electrically operated pumps will remove surface water collected within the bund and its composition will be verified through appropriate analysis prior to disposal.

13.8.10 The surface water drainage system will drain areas of the GEC site unlikely to be contaminated with oil due to their location and discharge the water to the storm water drainage system. The majority of the surface water drainage will be uncontaminated and typical of surface water run off from paved areas or roads. The potential for contamination is minimal and associated with areas around storage vessels which will be appropriately bunded.

13.8.11 An oily waste water drainage system will drain all areas where oil spillages could occur. The design will incorporate oil interceptors and traps. These will discharge with the other surface water discharge to the storm water discharge system. The discharge from each oil interceptor will contain no visible oil or grease.

13.8.12 Adequate facilities for the inspection and maintenance of oil interceptors will be provided and the interceptors will be emptied as necessary and desludged to ensure efficient operation. A qualified contractor will dispose of the sludge off-site.

13.8.13 All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.

13.8.14 GEC will be designed to take into account the flood risks associated with the site which is discussed in detail in the FRA included in Volume 2, Appendix D and summarised in this Section of the ES.

13.9 Assessment of Cumulative Effects

13.9.1 There is a very limited scope for cumulative impacts associated with the GEC development given the proposed mitigation measures that will be employed by the plant, during construction and operation, and the inherent low water usage of the plant processes. The water requirements in this Section have been based on worst case scenarios and do not allow for any efficiency savings that may be identified during the design and operation of the plant.

13.9.2 Any infrastructure associated with the proposed GEC including any gas, grid and CHP connections are not likely to have any significant impacts with regard to water quality if appropriate CEMP measures are employed. As a result there is not considered to be any potential for significant cumulative impacts in this regard.

SECTION 14

GEOLOGY, HYDROLOGY AND LAND CONTAMINATION

14 GEOLOGY, HYDROLOGY AND LAND CONTAMINATION

14.1 Summary

14.1.1 The site of the proposed GEC power station is situated on the north bank of the River Thames located between Stanford-le-Hope and Canvey Island. The site is a roughly rectangular shaped parcel of land and covers an area of approximately 11.3 ha of open rough grass and scrub land. The site is currently free from development.

14.1.2 Historical plans have confirmed the site and surrounding area's industrial legacy detailing the large scale development of the former Thames Haven Refinery and associated tank farms. Tributaries of the Rugward Fleet, which formerly flowed through the southern section of the site, converged on site before discharging into the River Thames some 200 m to the south of the site. It is not known if these water courses were diverted, in-filled or culverted.

14.1.3 British Geological Survey (BGS) maps and data from previous intrusive investigations indicate that the geological sequence beneath the site comprises topsoil and made ground overlying marine or estuarine alluvium (undifferentiated or clay) overlying solid geology of Lower London Tertiaries.

14.1.4 Previous site investigations undertaken across the site and surrounding area have identified significant levels of contamination within the ground and groundwater beneath the site. The contamination most likely originates from previous uses of the site for the storage and processing of bulk fuel products. A program of remediation is to be undertaken across the site prior to re-development works. Remediation validation reports will be produced as documentation of the works undertaken with the works undertaken to a standard such that the site can be developed for use as a power generating facility.

14.1.5 The groundwater beneath the site has been classified as a minor aquifer by the EA. Groundwater was encountered at depths between 2 and 4 m in the river terrace deposits during previous ground investigations. Perched groundwater was also encountered in the shallow made ground deposits. On site development appears to have included the infilling or culverting of water courses which are known to have been present on site in the 19th century. However, no evidence of these watercourses remain on or under the site with historic maps showing the re routing of these water courses over the course of the last century.

14.1.6 The potential impacts from the development are likely to be limited to the construction period and are associated with the potential to impact upon watercourses. In particular drainage systems / culverts that flow to the River Thames in the vicinity of the site. Providing adequate remediation of the site is undertaken, there are not anticipated to be risks to the health of construction workers or future site users. There are no residential properties within a 1 km radius of the site.

14.1.7 The construction period is of a relatively short duration and suitable mitigation measures, such as the use of Personal Protective Equipment (PPE) for all site workers and the use of silt traps and buffer zones, will be undertaken. A Working Practices Procedure for the Control of Pollution will be drafted for the projects construction phase to minimise impacts on the soil, geology, hydrology and hydrogeology. Likewise a Site Waste Management Plan (SWMP) will also be developed prior to construction and would concentrate on the reduction, re-use and recycling of waste generated.

14.1.8 Following mitigation, there are not anticipated to be any significant residual impacts relating to geology, hydrology or hydrogeology during the operational or construction phases of the GEC plant.

14.2 Introduction

14.2.1 This Section details the baseline geological, hydrological and hydrogeological conditions at the site and outlines the current and potential environmental impacts of the proposed development on these resources. It also details the status of the site in terms of ground and surface water contamination and the risks posed to human health (particularly future site users). Where potentially significant impacts have been identified, mitigation measures have been proposed to reduce the severity of such impacts to an acceptable level. The threat from flooding to the site has not been addressed in detail in this document. Although brief references have been made, a detailed flood risk assessment (FRA) has been submitted as Appendix D of this ES.

14.2.2 The GEC site is a relatively flat lying, rectangular parcel of land covering an approximate area of 11.3 ha. In its current state, the site is free from development and has a rough grass and scrub cover. The site is bound to the northeast by an oil storage depot. The remaining land surrounding the site is also free from development following the recent demolition and clearance of the Thames Haven Refinery but will soon be developed as part of the London Gateway Port / London Gateway Logistics Park development, collectively called the LG Development.

14.2.3 The site and surrounding area were formerly utilised for the processing and storage of fuel products and several tank farms covered the area. A number of previous site investigation reports, principally prepared by Environmental Resources Management (ERM), have been made available for review and have been referenced in this chapter of the ES.

14.3 Legislative Context and Key Policies

14.3.1 Baseline conditions have been assessed with reference to the Electricity Works (Environmental Impact Assessment) (England and Wales) Regulations 2000 the Environmental Protection Act 1990, the Contaminated Land (England) Regulations 2006, the Construction (Design and Management) Regulations 2007), British Standard BSI 6031 (1981) – 'Code of Practice for Earthworks, CLR 11 – Model Procedures for the Management of Land Contamination, The Definition of Waste: Development of Industry Code of Practice, CLAIRE, September 2008 and Planning Policy Statement 23 (PPS 23) Planning and Pollution Control.

Regional Policies

14.3.2 Section 3 provides the planning policy content. The policies listed below have informed the assessment process, to which reference has been made in Section 3. A full transcript of these policies is contained in Volume 2 Appendix A.

East of England Plan

WAT1	Water Efficiency
WAT2	Water Infrastructure
WM7	Provisions for Hazardous Waste and other Regionally Significant Facilities

Thurrock Borough Local Plan

BE26	Development of Contaminated Land

14.4 Assessment Methodology

14.4.1 The assessment approach has been undertaken with a clear understanding of the following:

- Previous land uses – through a review of historical maps;
- Underlying ground conditions – through a review of British Geological Survey (BGS) maps, and a review of previous site investigation reports.

- Existing physical baseline conditions;
- Development proposals;
- Sensitivity to change;
- Magnitude of change;
- Potential to mitigate impacts resulting from the proposed development.

14.4.2 Tables 14.1 to 14.3 have been used to assess the attribute importance of receptors and the significance criteria against which the magnitude of potential impacts from the development may have on soils, geology, hydrogeology and human health. In addition, a conceptual site model approach has been used to assess the risks posed by contaminants to human health using a source, pathway receptor model, based on the following:

- **Source** – potential source of contamination.
- **Pathway** – means by which contamination can reach and impact upon a receptor.
- **Receptor** – that which may be adversely affected by the presence of contamination.

14.4.3 The baseline geological, hydrological and hydrogeological conditions of the proposed site have been assessed with reference to the following:

- British Geological Survey (BGS) 1:50,000 Sheet 258/259, Southend and Foulness, Solid and Drift Edition
- Environmental Resources Management. Shell UK Oil Products Limited, Phase II: Shell Haven Refinery, Stanford-le-hope, October 2000 (logs only)
- Environmental Resources Management: Shell UK Oil Products Limited, Delineation Investigation: Quality Assurance Project Plan, October 2000;
- Environmental Resources Management: Shell UK Oil Products Limited, Phase I Remediation Works: Shell Haven Refinery, Delineation Investigation, DRAFT, August 2001;
- Fugro Engineering Services Limited. DP World, London Gateway, Ground investigation Wells, Report on Ground Investigation, November 2008;
- Envirocheck Report – order reference 29109000-1-1 which included the following:
    - Groundwater Vulnerability Map;
    - Historical plans from 1872 to 2006;
    - Details of discharge and waste consents, contaminated land sites and areas of sensitive land use for the site and a 1km radius of the site boundary;
    - Geological and mining hazards.
- Environment Agency flood maps, via http://maps.environment-agency.gov.uk/wiyby

14.5 Significance Criteria

14.5.1 Tables 14.1 to 14.3 define the criteria against which the magnitude and significance of impacts has been defined on a variety of receptors of varying sensitivity.

TABLE 14.1 - DEFINING ATTRIBUTE IMPORTANCE FOR RECEPTORS

		Attribute Type				
Attribute Sensitivity	**Geology / Soils**	***End users***	***Construction Workers***	***Surrounding Land Uses***	***Controlled Waters***	***Built Environment***
High	• Designated SSSI for geology/soils • Grade 1 agricultural land • Land supports nationally rare plant species	Residential, allotments, play areas	Extensive earthworks and demolition of buildings	Greenfield site / residential area	Major aquifer or surface water in close proximity to site	Listed buildings of high historic value or other sensitivity
Medium	• Grade 2 agricultural land • Currently used for important crops • Land supports regionally / locally rare plant species	Landscaping or public open space	Limited earthworks	Open space, commercial area	Minor aquifer	Buildings, including services and foundations
Low / Negligible	• Brownfield/industrial site. • Site of little or no agricultural value.	'Hard' end use (e.g. industrial, car parking)	Minimal ground disturbance	Industrial area	No surface water bodies or aquifers close to the site	n/a

TABLE 14.2 – CRITERIA FOR ASSESSING THE MAGNITUDE OF IMPACTS

Significance Criteria		***Description***
Major Impact	*Adverse*	A permanent or long term adverse impact on the integrity and value of an environmental attribute or receptor, or exposure to acutely toxic contaminants. For example, harm to human health, designated habitats or pollution to controlled waters.
	Beneficial	Large scale or major improvement of resource quality; extensive restoration or enhancement; major improvement of attribute quality.
Moderate Impact	*Adverse*	An adverse impact on the integrity and/or value of an environmental attribute or receptor, but recovery is possible in the medium term and no permanent impacts are predicted.
	Beneficial	Benefit to, or addition of, key characteristics, features, or elements or improvement of attribute quality.
Minor Impact	*Adverse*	An adverse impact on the value of an environmental attribute or receptor, but recovery is expected in the short-term and there would be no impact on its integrity. For example, temporary effects on receptors not designated under environmental legislation.
	Beneficial	Minor benefit to, or addition of key characteristics, features or elements; some beneficial impact on attribute or a reduction in the risk of a negative impact occurring.
Negligible impact		No impact would be detectable, either positive or negative.

TABLE 14.3 - DEFINING SIGNIFICANCE OF EFFECT CATEGORIES

		Magnitude of Impact				
		No Change	***Negligible***	***Minor***	***Moderate***	***Major***
Importance of Attribute	***High***	Neutral	Slight	Moderate	Large	Large
	Medium	Neutral	Slight	Slight	Moderate	Large
	Low	Neutral	Slight	Slight	Slight	Moderate
	Negligible	Neutral	Neutral	Neutral	Neutral	Neutral

14.6 Current Baseline Conditions and Receptors

Site History

14.6.1 The first edition OS plan from 1872 (1:10,560 scale) shows the site as undeveloped open fields located on the northern bank of the River Thames. Rugward Fleet flows from west to east along the southern area of the site before its confluence with the River Thames, approximately 200 m to the south of the site at Shelly Bay. A number of small streams flow across the site and converge in the central area and discharge into Rugward Fleet in the southern area of the site.

14.6.2 Development of the surrounding area is limited. A railway line runs from west to east along the southern site boundary serving the nearby Thames Haven Dock located approximately 200 m to the southeast of the site. The small settlements of Reedham and Oilmill Farm are located to the north and northeast respectively. A number of marsh lands and many small streams and tributaries of the River Thames are located within the surrounding area of the site.

14.6.3 The historical map of 1898 shows no significant changes within the site boundaries compared with the previous map of 1872. Areas to the north, east and west of the site also remain free from development. To the south of the site, Thames Haven Petroleum Wharf has been developed and comprises two large structures with many tanks, railway sidings and a pier. Thames Haven Dock to the southeast of the site has expanded further to the east.

14.6.4 No significant changes to the site and surrounding area have been noted on the historical plans of 1910 and 1922.

14.6.5 By the edition of 1924, the southern half of the proposed GEC site has been occupied by numerous tanks associated with Thames haven Oil Wharves. Further tanks have also been constructed to the southeast, west and southwest of the site. While the northern section of the site remains largely free from development, a number of small buildings have been constructed in this area and tanks are also noted adjacent to the northern boundary. The route of the streams and tributaries onsite appears to have remained unaltered from earlier edition plans. An explosives works is noted approximately 1 km to the northeast of the site and an oil works is situated adjacent to Thames Haven Pier, 1 km to the east.

14.6.6 The historical OS plans from 1938/39 no longer show the large number of tanks on the southern area of the site or on the land surrounding the site to the south and west. Only a few smaller buildings are detailed along with an area of raised ground where the tanks were previously shown. The oil works to the east of the site and the developments around Thames Haven Pier are also no longer evident. It is known that potentially sensitive sites were intentionally removed from recorded mapping during this period due to unrest leading up to the Second World War. Therefore it is considered unlikely that the site would have been cleared and that the infrastructure and development would have been similar or further increased, compared to that reflected in the previous edition OS Plan of 1924.

14.6.7 The next edition map of 1960 further supports this assumption as it shows development at the site has expanded significantly and is now fully developed with tanks, buildings and associated infrastructure. Land to the west and northwest of the site also hosts a large number of tanks and buildings, part of the oil storage facility. The majority of the river frontage land in the vicinity of the site is also occupied with tanks, buildings and associated infrastructure. The Rugward Fleet in the south of the site is now detailed as the Northside Fleet.

14.6.8 Plans from 1968 to 1986 show no change to the use of the site, although the layout and position of some structures have been altered and changed over time. The streams and tributaries that once crossed the site are no longer shown, having either been diverted or culverted. Large tanks have also been developed directly to the east of the site.

14.6.9 By 1999, only a few tanks and buildings remain in the south of the site. Large areas of land to the south and west have also been cleared of the previous structures, although there are still a number of large tanks in place. The Thames Haven area to the southeast has also undergone a period of clearance and a large area where tanks once stood is now shown as being flooded.

14.6.10 The 2006 edition reflects the current site status and shows the site has been cleared of all structures and associated infrastructure. The areas of land to the north, west and south and the Thames Haven area to the southeast are also clear of the majority of structures. The large flooded area shown on the previous edition is no longer shown, having either been in-filled, or allowed to drain. The tanks adjacent to the east of the site remain in place and are detailed as an oil storage depot, beyond which a power station is now shown.

14.6.11 In summary, the site and surrounding area has a major Industrial legacy and has been utilised predominantly for the storage and possible processing of oil and fuels. Many changes to the site layout appear to have taken place and areas of ground, in particular the area of the former Rugward Fleet, have been potentially in-filled with unknown materials. It is possible that large substructures, including foundations and pipe work remain in-situ beneath the surface of the site and contamination associated with the storage and production of hydrocarbon based products may have occurred.

Geology and Soils

14.6.12 BGS 1:50,000 Series, Sheet 258/259, Southend and Foulness, Solid and Drift Edition indicates that the superficial geology across the site comprises marine or estuarine alluvium (undifferentiated or clay) overlying solid geology of Lower London Tertiaries which comprise Woolwich beds (greenish yellow fine sand with frequent shell beds), Oldhaven Beds (firm yellow to buff fine sand) and Thanet Beds (predominantly silty fine sand).

14.6.13 The *Delineation Investigation: Quality Assurance Project Plan*, October 2000 carried out by ERM Ltd. detailed the following geological succession beneath the larger Thames Haven Refinery site.

Geological Strata	***Thickness***	***Description***	***Age***
Marine or estuarine alluvium	8 - 16	River Thames flood plain deposit – stiff brown clay overlying soft (dense) grey silty clay or clayey silt	Pleistocene and recent
Marine or estuarine sand and gravel	10 – 14	River terrace deposits – dense brown sandy fine to coarse gravel	Pleistocene
London Clay	0 - >25	Stiff high plasticity fissured silty clay	Eocene
Lower London Tertiaries	c. 50	Woolwich beds – interbedded fine sand, silt and clay with subordinate gravel beds, and Thanet beds – fine sands	Palaeocene
Upper Chalk	-	Fissured limestone with flint bands and some clays	Cretaceous

14.6.14 The ERM report further stated that the Phase II site investigation confirmed the geological succession beneath the site, however, the London Clay was absent from the majority of the site having been eroded by the River Thames and replaced with deposition of river terrace deposits.

14.6.15 Data relating to soils at the site was taken from Soilscape, a 1:2500 scale map showing soils Types in Britain (Cranfield University). Soils at the site are described by Soilscape as *'loamy and clayey soils of coastal flats with naturally high groundwater'.* These soils have moderate fertility and are usually overlain by arable and grassland cover.

14.6.16 Based on the above information, the attribute importance of soils and geology underlying the site has been classed as **low/negligible** as the site is not of high agricultural value, has not been designated a SSSI and has supported substantial industrial development in the past.

14.6.17 An assessment of the potential contamination issues at the site has been undertaken through a review of historical maps, a Landmark Envirocheck Report and the previous site investigation reports produced by ERM Ltd. (2000) and Fugro Ltd. (2008). The following summarises the findings of a review of this information:

14.6.18 An historical landfill site has been identified on site in the Envirocheck Report. The license holder (Ref: 1500/0014) for this facility is identified Shell UK Oil and the location is shown as being at the centre of the eastern site boundary. Deposited waste included special waste and liquid sludge. The last input date has not been supplied. A further four historical landfill sites have been identified within the 1 km search area of the Envirocheck Report. Details are given below:

- Located 23 m east of the site and operated by Shell UK Oil, deposited waste included special waste and liquid sludge. Last input date September 1989;
- Located 44 m northwest of the site and operated by Shell UK Limited, deposited waste included liquid sludge. Last input date December 1994;
- Located 256 m southeast of the site and operated by Shell UK Limited, deposited waste included industrial waste and liquid sludge. Last input date December 1994;
- Located 374 m northwest of the site and operated by Shell UK Limited, deposited waste included liquid sludge. Last input date August 1996.

14.6.19 Two local authority registered landfill sites have been identified within the search area, both located within 500 m of the site. Details are given below:

- Shell Haven Refinery (Ref: 97) located 74 m southwest of the site, details of waste and closure date are not supplied;
- Shell Haven Refinery, Thurrock (Ref: THU039) located 333 m southeast of the site. This landfill was for the disposal of oily sludges and the date of closure is unknown.

14.6.20 Two registered landfill sites are located within the Envirocheck 1 km search area, one of which is located on the site, as detailed below:

- Shell UK Oil Limited (License Ref: 65/79) operated the onsite landfill for tank cleaning sludge which was produced on site. The license, which commenced in June 1979, is now detailed as lapsed, cancelled or surrendered. No details on volumes of waste permitted have been supplied;
- A second registered landfill site operated by Shell UK limited (License Ref: 96/83) has been identified 68 m northwest of the site and was for the disposal of oil / water mixtures. Maximum waste input rates were small (equal to or

greater than 10,000 tonnes but less than 25,000 tonnes). This license commenced in April 1983 and is also detailed as lapsed, cancelled or surrendered.

14.6.21 A total of twenty-nine discharge consents have been identified within 1 km of the site in the Envirocheck report. Details of discharge consents located within 250 m of the site are summarised below:

- London and Thames Haven Oil Wharves Limited operated a consent to discharge sewage in to Curry Marsh sewer located 61 m to the south of the site. This licence was revoked in March 1992;
- Shell UK Oil limited operated a consent to discharge Other Matter - Surface Water. The receiving water has not been identified but the location is detailed 168 m southwest of the site and the licence was revoked in March 1992;
- A further discharge consent was operated by Thames Haven Oil Wharves Limited until March 1992 for the discharge of Trade Effluent in a tributary of the River Thames.

14.6.22 There have been seven pollution incidents to controlled waters recorded within 1 km of the site. These are summarised below:

- A rail collision lead to a spillage of oil gas in to a freshwater stream / river in May 1994 approximately 200 m to the southeast of the site. The incident was classed as a category 3 minor incident;
- A category 2 major incident occurred approximately 570 m to the southwest of the site in August 1991. The pollutant was identified as oils but all other information has not been detailed;
- In April 1999, a pollution incident to controlled waters occurred 576 m to the southwest of the site. The pollutant was identified as oils, and the severity of the incident was classed as a Category 3 minor incident;
- A pollution incident to controlled waters occurred at Shell UK Oil Refinery 800 m to the west of the site in October 1997. The pollutant was unknown and the incident was given a severity rating of category 3 minor incident;
- A further category 3 minor incident was recorded in Holehaven, 864 m to the west of the site in December 1993. Again the pollutant was identified as oils;
- Again a category 3 incident was recorded 880 m west of the site at Shellhaven with the pollutant identified as oils. This incident occurred in November 1994 but the receiving waters were not identified;
- A tributary to Holehaven Creek was the receiving water of an unknown pollutant in April 1993. This incident was given a category 3 minor incident severity rating and occurred 928 m to the northwest of the site.

14.6.23 Although several pollution incidents to controlled waters have occurred within 1 km of the site, considering the distance from the site and time since these incidents occurred, it is unlikely that any of these incidents would have a significant impact on the quality of the land at the site.

14.6.24 Several landfill sites have been identified on site and in close proximity of the site. Due to the age of these landfill sites, it is unlikely that they were constructed using modern engineered containment systems. Wastes accepted at these landfill sites included special waste and liquid sludges.

14.6.25 As the landfill sites were unlikely to have been lined, there is a significant potential that leachate and ground gas could migrate on or off site and potentially contaminate the soils and groundwater beneath the development site.

14.6.26 The land surrounding the site has also been utilised for the storage and production of fuel products and the area to the northeast is still occupied by an oil storage depot. The potential exists therefore that contamination from the surrounding land could have migrated on to site from the surrounding land.

14.6.27 Following the original phase II intrusive site investigation, ERM undertook a delineation investigation across the 310 ha Shell Haven Refinery site in August 2001, which included the proposed CCGT site. A series of trial pits and boreholes were undertaken across the site and free product with a hydrocarbon odour was noted in a number of the exploratory holes, especially in the southern area of the site. Laboratory analysis of soil samples from this area also showed elevated levels of hydrocarbons.

14.6.28 The Remediation Delineation report highlighted hydrocarbon impact beneath the site with BTEX exceedance and evidence of buried mobile product.

14.6.29 During the site walkover, stockpiles of granular material clearly impacted with hydrocarbon contamination were noted on the land adjacent to the northwest of the site. It appeared that this material had been excavated from this area and has not been imported from another site.

14.6.30 In summary, there is a **high** potential of contaminated soils and groundwaters beneath the site.

14.6.31 In advance of any construction works a program of remediation is to be undertaken across the GEC site. Remediation Validation Reports will be produced as documentation of the works undertaken. Discussions with the ongoing in this regard with the EA, amongst others.

14.6.32 The stability of soils at the site has not been assessed via ground investigation. Prior to construction, boreholes should be drilled across the site to significant depth and a full programme of geotechnical testing will be undertaken in order to test the strength and suitability of the underlying geology to support foundations and inform the plant foundation design.

UXO

14.6.33 Adjacent sites to the proposed GEC land have previously been used as explosives factories. Additionally, the sensitive location of the site, on the banks of the Thames, and the historical use of the site as a large oil refinery during both World Wars One and Two means that it was a likely target for German bombing raids. There is therefore the potential for unexploded ordnance (UXO) to be present on site.

14.6.34 A UXO survey of the former Thames Haven Refinery has concluded that there is the potential for unexploded ordnance to be present on site.

Landscape and Topography

14.6.35 The site is relatively flat lying and covers an area of approximately 11.3 ha. The site has a rough grass and scrub cover and, along with the surrounding land, currently stands vacant with the exception of the land to the northwest of the site where an oil storage facility exists. Topographic data for the site reveals that it lies at approximately 2.1 m AOD. An area of slightly higher ground exists to the north and west of the Thames Haven landholding.

14.6.36 The proposed development site is situated on land classified as Urban under the Defra Agricultural Land Classification (ALC) and is currently covered with rough grass and scrub. Urban land is classified as "*Built-up or 'hard' uses with relatively little* *potential for a return to agriculture including: housing, industry, commerce, education, transport, religious buildings, cemeteries. Also, hard-surfaced sports facilities, permanent caravan sites and vacant land; all types of derelict land, including mineral workings which are only likely to be reclaimed using derelict land grants".*

14.6.37 Land surrounding the site is classed as a mixture of grade 4 or 'urban' land. Land of grade 4 is classified as *"poor quality agricultural land with severe limitations which significantly restrict the range of crops and/or level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land".*

Hydrogeology

14.6.38 The geology underlying the site is classed by the EA as a Minor Aquifer (variably permeable). These formations can be fractured or potentially fractured rocks, which do not have a high primary permeability, or other formations of variable permeability including unconsolidated deposits. Although not producing large quantities of water for abstraction, they are important for local supplies and in supplying base flow to rivers.

14.6.39 The soils overlying the bedrock have been classified as being of high leaching potential (U). Soil information for restored mineral workings and urban areas are based on fewer observations than elsewhere. A worst case vulnerability classification is therefore assumed until proven otherwise.

14.6.40 The site is not located within a source protection zone.

14.6.41 Previous ground investigations at the site in 2000 identified three groundwater bodies beneath the overall Shell Haven facility:

- *Perched Groundwater* – the site occupies former marshland, some fleets and waterlogged ground still remain giving evidence of a shallow groundwater table. These groundwaters are perched upon the low permeability alluvium within its upper strata or made ground and principally sourced from rainwater infiltration. The perched groundwater was generally encountered at depths of less than 1.0 m bgl but conditions may vary significantly across the site;
- *River Terrace Deposits* – comprise the first significantly permeable strata beneath the site. Standing groundwater levels recorded during the site investigation varied from between 2.0 and 4.0m bgl. Within the River Terrace deposits, tidal influence from the Thames estuary was recorded towards the south of the site.
- *Upper Chalk* – The chalk deposits underlying the site are classified as a major aquifer. However, this groundwater body lies at a significant depth below the site. Although the overlying tertiary deposits may be in hydraulic continuity with the chalk, migration between these aquifers is restricted by the overlying London Clay, and low permeability layers of the tertiaries.

14.6.42 The Envirocheck Report indicates that there are no licensed groundwater abstractions within 1 km of the site boundary.

14.6.43 Overall, the attribute importance of the underlying aquifer has been assessed as **medium**, principally as it has been classified as a Minor Aquifer by the EA and also because it may be in hydraulic continuity with the Thames Estuary.

Hydrology

14.6.44 The principal hydrological feature in the vicinity of the site is the River Thames which at its closest point (Shelly Bay) is located approximately 200 m to the south of the site. At this location the tidal River Thames is over 2 km wide, however, no water quality data has been made available in the Envirocheck report.

14.6.45 Previously, Rugward Fleet flowed from east to west across the southern area of the site before it's confluence with the River Thames at Shelly Bay, 200 m to the south. A number of smaller tributaries were also present across the site prior to the development of the tank facilities. It is not known if these water courses have been in-filled, culverted or diverted.

14.6.46 The River Thames and its estuary is a major watercourse of national importance and is considered as an important body for both recreation and ecology. Also the Essex Coast in the area of the site has been identified as an Environmentally Sensitive Area. Therefore, the attribute importance for the River Thames has been defined as **high**.

14.6.47 The Envirocheck report identifies four licensed surface water abstractions all of which are located between 1250 m and 1775 m from the site. These abstraction points are not considered significant to the proposed development as they are located some distance from the site.

14.6.48 EA flood maps show that the site and surround area lies within an area at risk of flooding (Flood Zone 3). Generally this means that the chance of flooding each year from rivers or the sea is 1 in 100. The map also shows that the site is protected by flood defences. The flood risk to the site has been assessed as part of a separate flood risk assessment, submitted as an appendix to this ES.

Conceptual Site Model (CSM)

14.6.49 Based on information taken from historical maps, the Envirocheck Report, site walkover and previous intrusive investigations, the following Conceptual Site Model (CSM) (Table 14.4) has been developed describing the main potential sources of contamination, likely pathways for migration and most sensitive receptors.

TABLE 14.4 CONCEPTUAL SITE MODEL

Source	***Potential Contaminants***	***Pathway(s)***	***Receptor(s)***
Historical use of site and surrounding area for fuel storage and manufacture	Hydrocarbons, heavy metals, ground gas / vapour	Granular soils, groundwater, surface water, Oral and dermal contact with soil and water	Current site users, construction workers, future site users, future on site development.
Historical landfill sites, both on and off site.	Leachate, landfill gas	Granular soils, groundwater, surfacewater	Current site users, construction workers, future site users, future onsite developments

14.7 Future Baseline Conditions

14.7.1 As previously described, the GEC site will be cleared of all contamination by LG prior to development of the GEC.

14.7.2 By 2011, which represents the start of the future baseline, the GEC site will comprise bare earth and hardstanding and will be devoid of vegetation. All contamination will be removed during a full programme of remediation works. There is therefore not anticipated to be any contamination underlying the site following remediation. All sources of contamination will be removed, therefore breaking the pollutant linkage in the Conceptual Site Model.

14.8 Potential Impacts

14.8.1 When assessing the potential impacts relating to the construction phase of the development, it has been assumed that several confirmed mitigation measures will be applied to the works. These include adherence to best practice and maintaining safe working practices at all times.

14.8.2 The confirmed mitigation measures comprise adherence to the following documents:

- *Protection of Workers and the General Public during the Development of Contaminated Land, HSE, 1991. This document establishes the key principles to take into account when designing and implementing work on contaminated sites, in order to ensure the proper protection of the health and safety of employees and others who may be affected by such work;*
- *A Guide to Safe Working on Contaminated Sites, R132, CIRIA, 1996. This document is similar to the HSE document, and also includes checklists to help in the preparation of health and safety risk assessments and the development of safe working practises.*

Construction

Human Health (Construction Workers)

14.8.3 Existing soil conditions are not anticipated to negatively impact upon construction workers as a result of the construction phase of the Development. Potential impacts to health, arising from oral, inhalation or dermal contact with potential contaminants within the made ground are negated by the implementation of confirmed mitigation measures such as working in accordance with best practise and the use of correct and appropriate Personal Protective Equipment (PPE) at all times.

14.8.4 There is considered to be a potential impact on the health of construction workers due to the possible inhalation or explosive nature of ground gases from old landfilling operations on, and off site. However, this risk will also be eliminated by best practice and confirmed mitigation measures.

Geology and Soils

14.8.5 The importance of the underlying geology and soils at the site have both been assessed as **low/negligible** as they are not of high agricultural value and have not been designated for their geological importance. The disturbance of underlying deposits will be limited mainly to topsoil and underlying made ground and alluvium. The development is not considered to result in the loss of large amounts of soils or geology when compared to similar areas of the same underlying deposits in the surrounding area. In addition, the future potential of the site is limited as it has been historically surrounded by major industrial development, an oil storage facility exists adjacent to the northeast of the site and the site holds no significant agricultural value.

14.8.6 ERM identified soils and groundwater impacted with hydrocarbons during the Remediation Delineation Report 200, however, the level of remedial action taken at the site to date is unclear. The soils and groundwater beneath the site would be required to be of a suitable quality for the proposed development and remedial works are almost certain to be required. Therefore, the construction of the proposed CCGT would require clean up of the site and overall it is considered to have a **moderate beneficial impact** on the underlying geology and soils of the site, resulting in a **Slight beneficial** overall significance of effect.

Hydrogeology / Hydrology

14.8.7 Construction activities on any site may, if uncontrolled, cause changes to surface and water drainage due to:

- The creation of soil piles;
- Compaction of soil due to the movement of heavy equipment;
- Removal of vegetated top soil; and
- The provision of access tracks.

14.8.8 A small amount of water will be required each day for the general construction works and hygiene, which is likely to be brought to site by bowser or taken from the towns supply to the site. No surface water or groundwater abstraction will be required. This water used during construction would be for the construction of access roads, dust suppression and wheel-washing facilities.

14.8.9 Nearby surface water quality may be affected by increased sediment load of any surface water discharge. Silt can cause lasting damage to surface water biology and can also build up to cause flooding. The River Thames is located approximately 200 m south of the site and is the most significant surface water feature within a 1 km radius of the site. The Thames is a major watercourse and is considered important for both ecology and recreation in the region and the attribute importance has been assessed as **high**. However, the river is located such that on site construction activities are unlikely to affect the river directly due to distance. The overall significance of effect of direct impacts on the River Thames has therefore been assessed as **neutral** as there would be a **negligible** impact on a receptor of **high importance.**

14.8.10 Historical plans have shown that a number of streams converged on site with the Rugward Fleet, which flowed from east to west across the southern section of the site. However, no evidence of these watercourses remain on site. Additionally, historical maps from 1924 show at least one of these watercourses has been diverted around the development of the storage tanks at the site. The watercourses appear to have reduced in size significantly on OS maps of 1960 and they are labelled as drains on maps from 1968. It can therefore be assumed that these drains were managed for effluent flow and potential contamination issues by Shell. All but one of the smallest of these drains is shown on maps from 2006. It can therefore be assumed that they have been removed by Shell as part of the ongoing remediation strategy at the site and hence they no longer represent a threat of transporting contamination to the Thames.

14.8.11 The construction of deep foundations (e.g. piled foundations on to bedrock) could offer a preferential pathway for contaminants to impact upon any groundwater bodies beneath the site. Groundwater was encountered in three strata beneath the site during the ERM investigations and indicates that the groundwater lies within 2-4 m bgl within the river terrace deposits. This groundwater body has been classified as a minor aquifer by the EA and is therefore likely to be in hydraulic continuity with the River Thames. The groundwater resource has therefore been assessed as a receptor which is **medium sensitive**. There is also considered to be a potentially **moderate adverse** impact on this receptor without mitigation. Therefore, the overall significance of effect without mitigation has been assessed as **medium**.

14.8.12 The construction of areas of hardstanding, access tracks and construction laydown areas will result in some interception of natural surface water drainage routes. However, due to the relatively small percentage of land-take of these areas they will have a **negligible impact** on groundwater recharge and the volume of run-off flowing into site drainage systems.

14.8.13 There is the potential for **minor adverse** impacts due to the interruption to lateral drainage as a result of the installation of foundations, although no significant issues in this regard are expected. Where field drains are encountered these will be rerouted as necessary. Where foundation works penetrate the water table there may be a minor change in recharge characteristics and deep foundations (e.g. piling to bedrock) may inhibit groundwater flow. However, this is likely to be insignificant when taking into consideration overall groundwater flows for the site and surrounding area.

Operation

Human Health

14.8.14 The CCGT site will be predominantly covered with buildings or areas of hardstanding. A small area of the site will be landscaped but no areas of exposed (unvegetated) soils will be present. Additionally, a full remediation program and clean up strategy of the site will be undertaken prior to development of the CCGT. As a result the potential pathway between any ground contaminants and future site users will be broken. It is therefore considered that the potential for direct (dermal, oral or inhalation) contact with any remaining contaminants present beneath the surface is insignificant for future site operatives.

Water Use / Hydrology / Hydrogeology

14.8.15 Development of the site will include drainage and sewage systems which should be designed with incorporated oil interceptors and silt traps. A storm water attenuation pond may also be constructed on site to prevent off site discharges of large quantities of stormwater runoff. The majority of the site will have a hardstanding cover which will prevent the downward migration of pollutants into soils and groundwater. The conversion of the site from its current soft cover into structures with associated hardstanding areas will impact on the overall drainage regime at the site by increasing the amount of surface water runoff. However, all surface water will be channelled into a suitably designed drainage system and no runoff will be discharged directly into any surface water courses. The impacts are therefore considered insignificant.

Oil and Pollution Spills

14.8.16 During operation, only relatively small quantities of potentially hazardous substances will be stored and used at the site. These substances, which are detailed further in Section 4 of this ES mainly comprise transformer and lubricating oils and de-scaling chemicals which will be used in the boiler. No significant problems are anticipated in dealing with any of these substances as all confirmed mitigation measures will be followed, including working to best practice guidance such as PPG10 and oil storage regulations.

Decommissioning

14.8.17 The impacts on geology, soils, surface and ground water during decommissioning will be temporary and moderate in nature and would be similar to those described above for construction.

14.8.18 The concrete foundations will be removed, following decommissioning of the CCGT plant, save for piles which will be cut off approximately 2m below ground level. It is common for concrete foundations to remain in the ground for many years following decommissioning of such sites. The environmental impact of this is considered to be negligible as the foundations will be constructed of an appropriate grade of concrete to resist attack from soil and groundwater contamination. Other than the remaining foundations, the ground will be reinstated back to its original state (before the CCGT was commissioned) with suitably clean topsoil and grass covering where appropriate.

14.8.19 The effects on geology and soil during decommissioning are expected to be minor adverse and similar to those for construction.

14.9 Mitigation

14.9.1 The construction of the CCGT has the potential to create several impacts relating to human health and surface water / groundwater quality. However, providing that the confirmed mitigation measures are adhered to, other, stringent mitigation measures are unlikely to be needed, particularly if the site is fully remediated by Shell prior to construction.

Construction

Construction Workers / Current Site Users / Off Site Properties

14.9.2 Gas monitoring and accurate characterisation of the gassing regime at the site will be undertaken prior to construction. Gas monitoring standpipes will be placed around the site. Suitable PPE including the recommended grade of respiratory equipment can then be made available in order to minimise any potential impacts.

14.9.3 Dust suppression measures will be put in place to minimise dust levels on the site and in the surrounding environment. These measures are detailed in Section 9, Air Quality and include dowsing or covering of stockpiles during dry and windy weather.

14.9.4 Any additional soil materials that are to be imported to the sites will be required to have certification of their chemical concentrations to ensure that contaminative materials are not being introduced to the area.

14.9.5 The construction site will be fenced and site controlled access will be limited to construction workers and official vehicles. The site will be manned with security 24 hours a day during construction. This will prevent any members of the public from coming into contact with potentially contaminated materials.

Geology and Soils

14.9.6 In order to further limit disturbance, the site access tracks will be constructed first to allow movement of vehicles around the site on areas of soft-standing. Any vegetation, topsoil and subsoil will be removed to expose a suitable sub-grade. Any soils, sub-soils or aggregate suitable for reuse will be stockpiled on impermeable liners. Soils which are to be reused onsite will be tested geotechnically and for contamination. This will form part of a site waste management plan (SWMP) which will be drafted prior to construction and will focus on the re-use, recycling and reduction of waste spoil.

14.9.7 Speed restrictions will be imposed on site to minimise disturbance of bare surfaces and the amount of disturbed surfaces left exposed for significant time periods will be minimised. Stockpiles of loose, fine materials will be damped down or covered over if necessary, again to reduce erosion and the production of dust. The control of airborne dust is discussed in Section 9 of this ES - Air Quality.

Water Use, Disposal and Hydrology

14.9.8 The access roads will be constructed to manage drainage of surface water and a temporary wheel washing facility will be installed to prevent transfer of soil onto nearby public roads.

14.9.9 If any existing surface water drains on site interfere with the CCGT location, they will be re-routed prior to development of the site. This will move them directly away from the influence of construction activities.

14.9.10 Surface water, perched waters or groundwater from dewatering operations will not be discharged to surface water, foul or surface water drains without the appropriate consents from the local water or Sewage Company and / or the EA. The disposal of this effluent will be the responsibility of the contractor. If necessary this water will be tanked off-site for disposal at a suitable facility.

14.9.11 Temporary drainage routes and silt fences, constructed of geotextile, will be constructed if deemed necessary. Any pumping will be undertaken at such a rate using an appropriately sized pump in order to avoid disturbance or erosion of the stream banks. The location of dewatering pipework will be carefully positioned. The contractor will regularly inspect all dewatering pumps, pipe work and connections.

Operation

14.9.12 All foundations will be appropriately specified to resist chemical attack from soils or groundwater.

14.9.13 Foundations will also be designed so as not to present a preferential pathway for contaminant migration, if present at the site.

Decommissioning

14.9.14 A decommissioning plan will be prepared in compliance with best practice 12 months prior to decommissioning.

14.9.15 At this stage it is anticipated that the decommissioning area will be delineated and measures taken to avoid vehicle use outside the working boundary. In order to further limit disturbance, the site access tracks will be taken out last.

14.9.16 Any soils, sub-soils or aggregate suitable for reuse will be stockpiled on impermeable liners.

14.9.17 Dust suppression measures will be put in place to minimise dust levels on the site and in the surrounding environment. These measures are detailed in Section 9 of this ES - Air Quality.

14.9.18 Any additional soil materials that are to be imported to the site will be required to have certification of their chemical concentrations to ensure that contaminative materials are not being introduced to the area.

14.9.19 Speed restrictions will be imposed on site to minimise disturbance of bare surfaces and the amount of disturbed surfaces left exposed for significant time periods will also be kept to a minimum.

14.9.20 The site will be re-instated (as far as is reasonably possible) to its former use. Clean topsoil and turf will be imported where necessary and the site will be re-graded.

14.10 Assessment of Residual Impacts

14.10.1 Provided the mitigation measures detailed in Section 14.8 are strictly followed, it is not anticipated that any residual impacts will arise from the development influencing soils and geology, hydrology, drainage and hydrogeology, the health of construction workers, or the health of current site users / off site properties. The assessment of residual impacts has been summarised in Table 14.5 below:

TABLE 14.5 - ASSESSMENT OF RESIDUAL IMPACTS ON ATTRIBUTES

	Attribute					
	Geology/Soils	**End users**	**Construction Workers**	**Surrounding Land Uses**	**Controlled Waters**	**Built Environment**
Potential Impact	Negligible impact – land is of little agricultural value, not designated a SSSI	Negligible impact. End users defined as low sensitivity because of hard standing/industrial end use of the site.	Negligible impact under future baseline scenario	Negligible impact. Surrounding land use considered industrial.	Moderate impact. Hydrogeology classified as minor aquifer. Thames as high sensitivity Mitigation measures will limit any impacts to watercourses (e.g. River Thames).	N/A
Mitigation	Confirmed mitigation measures such as safe working practices will eliminate any potential impacts from oil spills etc.	Site will be covered in hardstanding, thereby breaking any pollutant linkages.	Confirmed mitigation measures (e.g. appropriate use of PPE) and remediation strategy by LG will limit any potential impacts	Confirmed best practice working procedures such as cordoning off the construction site will further limit any potential impacts	Confirmed best practice mitigation measures such as siting stockpiles away from watercourses and preventing run off from open excavations	
Residual Impact	No Impact	No impact	No impact	No impact	No impact	

14.11 Assessment of Cumulative Impacts

14.11.1 The GEC development will form part of the wider LG Development that has previously been the subject of a number of EIAs and planning submissions. All planning applications submitted thus far have been approved by the relevant authorities.

14.11.2 The development of the surrounding LG site will include mitigation measures sufficient to adequately mitigate the impact of the LG project and has assumed that the development site would be used for industrial purposes.

14.11.3 The studies for the GEC project have found that cumulative impacts will be minimal and insignificant due in no small part to the site specific nature of the impacts considered and the setting of the GEC plant in the surrounding LG Development.

14.11.4 The impacts associated with any gas, CHP and HV electricity interconnections for GEC are unlikely to give rise to any significant cumulative impacts when considered in conjunction with the GEC. This is due to the site specific nature of the impacts considered and the low potential for any significant adverse impacts associated with these associated works.

SECTION 15

TRAFFIC AND INFRASTRUCTURE

15 TRAFFIC AND INFRASTRUCTURE

15.1 Summary

15.1.1 Currently there are three access points to the LG Development know as Gates 1, 2 and 3. Access to the proposed site will be through the LG Business and Logistics Park. The existing roads on the LG landholding will connect the GEC site entrance, on the west boundary of the GEC site, to the A1014 Manorway (Gate 3 of the LG Business and Logistics Park) and via the A13, to the M25 motorway.

15.1.2 The construction period of the proposed plant will be of between 28 and 36 months in duration. The construction workforce is expected to peak at approximately 600 personnel per day, with an average of around 220 per day over the entire construction phase.

15.1.3 A Transport Management Plan will be agreed with Thurrock Council, as the local highways authority, prior to the commencement of the construction phase to help mitigate any potential impact of the proposed works to local and regional traffic and infrastructure. As part of the plan, GECL will seek to implement sustainable transport mode-share targets for construction staff to reduce the number of vehicles anticipated to visit the site, including the additional use of public transport and car sharing will be encouraged.

15.1.4 In addition to staff transport movements, construction traffic will consist of civil works traffic, mechanical works traffic and a small number of abnormal loads for components such as the gas and steam turbine(s). Approximately 75 heavy goods vehicles per day will be expected on average, with 150 per day at the peak of construction. Vehicles delivering to the site are likely to be spread throughout the day.

15.1.5 The exact number of abnormal loads will depend upon the final configuration of the GEC and will only be finalised during the construction contract tendering process. It is anticipated that this will be of the order of 10 to 15 over the full construction phase. The transport of abnormal loads, which may lead to delays and cause inconvenience to other road users, would be timed following consultation with the relevant authorities to minimise any potential disruption.

15.1.6 The operational workforce would be of the order of 15 to 25 personnel if the power plant is operated in conjunction with the existing CECL CCGT Power Station, or up to 40 personnel if the plant is operated on a stand-alone basis. Up to an additional 20 contracted staff will be present on site each day for the provision of general site maintenance services. As a worst case, this assessment has assumed that the GEC will operate on a stand-alone basis.

15.1.7 During major maintenance outages up to 400 temporary staff may visit the site for a period of about a month. Planned major outages will occur every three years.

15.2 Introduction

15.2.1 This Section presents the results of an investigation into the potential impact of GEC on local traffic and infrastructure. Details of the assessment methodology and significance criteria are provided, together with the baseline conditions upon which the study and conclusions are based.

15.2.2 All significant potential impacts are discussed and proposed mitigation and management methods are detailed, as appropriate.

15.3 Key Planning Policies

15.3.1 Section 3 provides the planning policy content. The policies listed below have informed the assessment process, to which reference has been made in Section 3. A full transcript of these policies is contained in Volume 2 Appendix A.

East of England Plan

T1	Regional Transport Strategy Objective and Outcome
T2	Changing Travel Behaviour
T6	Strategic and Regional Road Networks
T9	Walking, Cycling and other Non- Motorised Transport
T10	Freight Movement
T11	Access to Ports
T14	Parking
ETG6	Transport Infrastructure

Thurrock Borough Local Plan

T1	Balanced Transport Strategies
T6	Traffic Management
T8	Existing and New Public Footpaths
T11	Cycleways
T18	Railways – Freight Facilities
T20	Waterways – Freight Facilites

15.4 Assessment Methodology and Significance Criteria

15.4.1 The transport assessment has been undertaken in accordance with the Department for Transport's (DfT) Guidance on Transport Assessment (March 2007).

15.4.2 In order to understand the context and scale of the implications on local transport, the baseline conditions have been determined through a desk study of current available data from the DfT website and the Highways Agency TRADS2 database.

15.4.3 The connection offer from the National Grid Company (NGC) is such that construction of GEC would likely commence in 2012.

15.4.4 The construction phase is expected to last for between 28 and 36 months, with a peak on-site staff resource occurring in early 2014. The target date for full operation of the plant is 2015. Accordingly, the study has focused on these two key years over the proposed development span.

15.4.5 The background traffic data for future years has been derived using the National Road Traffic Forecasts 1997 (NRTF) growth factors for the relevant years, as shown in Table 15.1, to calculate an estimated percentage traffic growth as shown in Table 15.2. The majority of the baseline data used in this assessment is for 2008.

TABLE 15.1: NRTF 1997 GROWTH FACTORS

Base Year	***Future Year***	
2008	2014	2015
122.6	134.0	136.0

TABLE 15.2: PERCENTAGE GROWTH FORECASTS (GREAT BRITAIN)

Future Year	***Growth (%)***
2014	9.3
2015	10.9

15.4.6 The background traffic data for future years has been derived using the National Road Traffic Forecasts 1997 (NRTF) growth factors for the relevant years to calculate an estimated percentage traffic growth, locally adjusted using TEMPRO.

15.4.7 Assessment of the impact on the local road network by the traffic associated with GEC has been made using the capacity of the roads as estimated by the Design

Manual for Roads and Bridges (DMRB), particularly Advice Notes TA79/99 and TA46/97, and the ratio of flow to capacity (RFC).

15.4.8 Advice Note TA79/99 estimates the capacity of urban roads by classifying such roads by type and carriageway width.

15.4.9 Advice Note TA46/97 defines the Congestion Reference Flow (CRF) as an estimate of the Annual Average Daily Traffic (AADT) at which a carriageway is likely to be congested during the peak periods of an average day.

15.4.10 DfT guidelines suggest that the threshold for satisfactory operation of a road is a RFC less than 85 per cent.

15.4.11 The operational workforce would be of the order of 15 to 25 personnel if the power plant is operated in conjunction with the existing CECL CCGT Power Station, or up to 40 personnel if the plant is operated on a stand-alone basis. As a worst case, this assessment has assumed that the GEC will operate on a stand-alone basis.

Significance Criteria

15.4.12 Assessment of the impact on the local road network has been made using the capacity of the roads affected by the traffic relating to the proposed plant, as estimated using the Design Manual for Roads and Bridges.

15.4.13 The significance criteria of the impacts on the existing transport structure are defined as:

- Major: Causes high, lasting, disruption requiring extensive mitigation
- Moderate: Causes a RFC greater than 85 per cent AND / OR moderate disruption; requires mitigation
- Minor: Does not cause a RFC greater than 85 per cent AND low disruption; requires no mitigation
- Insignificant: Does not cause a RFC greater than 85 per cent AND no perceived impact.

15.5 Baseline Conditions and Receptors

Study Area

15.5.1 The local road network in the vicinity of GEC is shown in Figure 1.1.

15.5.2 Construction of GEC will generate workforce traffic and heavy goods vehicle (HGV) traffic on a daily basis. In order to reduce the impact on the local road network it is anticipated that all vehicles will access and leave the site via the route described below.

15.5.3 The M25 runs north/south approximately 10 km west of the proposed site boundary. The M25 is the major road link in the area and is a 3-lane motorway at Junction 30 where it connects with the A13. The A13 connects the centre of London to Shoeburyness and is of Trunk Road standard, comprising 3 lanes in each direction eastward to the junction with the A128. Further eastward, the A13 road standard reduces to a primary dual carriageway and connects with the A1014 Manorway west of Stanford-le-Hope.

15.5.4 Access to the proposed site will be through the LG landholding. The existing road infrastructure within the LG landholding will connect the GEC site entrance, on the west boundary of the GEC site, to the A1014 Manorway. This is known as Gate 3 of the LG Business and Logistics Park.

Traffic Data

15.5.5 The Department for Transport (DfT) calculates traffic estimates for each link of Great Britain's major road network and presents them as two-way Annual Average Daily Traffic (AADT) flows[12]. AADT data for the A13 and A1014 for several points within the study area has been used this study. The data is presented in Table 15.3.

TABLE 15.3: ANNUAL AVERAGE DAILY TRAFFIC (2008)

Road (Count Point)	*AADT*
A13 (between A1012 and A1089)	83 434
A13 Stanford-le-Hope Bypass (east of A128)	71 491
A1014 (exit of A13/A1014 roundabout)	23 227
A1014 (east of Southend Road junction)	17 122
A1014 (north of Hassenbrook School)	11 644
A1014 (north of London Gateway)	4190

15.5.6 The TRADS2 database provides a record of traffic flow data for motorways and trunk roads in England. However, the data available from the TRADS2 database for the GEC study area is limited to the A13. TRADS2 count points on the A13, within the east of the junction with the A1089, have been used to derive the daily pattern of traffic along the section of the A1014 detailed in Table 15.3.

Reference Flows

15.5.7 The capacity of the study route can be calculated using Advice Note TA46/97 that defines the CRF as an estimate of the AADT at which a carriageway is likely to be congested in the peak periods of an average day.

15.5.8 The A13 and A1014 carriageways are approximately 7.3 m wide at their narrowest points. For the purposes of this assessment, this is taken as the assumed road width along the length of the proposed route to GEC site. However, from the Junction 30 of the M25, the A13 consists of three-lanes with a carriageway width of approximately 10.8 m.

15.5.9 Using calculations detailed within Advice Note TA46/97, the maximum sustainable hourly lane throughput of the A13 is around 1880 vehicles, in the direction affected by the traffic of GEC. The maximum two-way capacity is approximately 6825 (using the derived 58 per cent directional split of the two-lane section of the A13). Based on this throughput, the CRF is approximately 70 700.

15.5.10 The CRF for the A1014 is approximately 67 515 for the dual carriageway to Coryton. As the road continues east past the London Gateway site the A1014 becomes a single carriageway and the CRF reduces to approximately 18 040.

15.5.11 Table 15.4 details the CRF for the proposed GEC site access route, and the associated traffic flows. Future traffic flows have been estimated using locally adjusted NRTF growth factors.

[12] http://www.dft.gov.uk/matrix

TABLE 15.4: CURRENT AND FUTURE REFERENCE FLOWS

Road (Carriageway)	*CRF*	*AADT (2008)*	*Ratio AADT/CRF (%, 2008)*	*AADT (2014)*	*Ratio AADT/CRF (%, 2014)*
A13 (3-Lane)	96 462	83 434	86.5	92 740	96.1
A13 (dual)	70 703	74 191	104.9	82 466	116.6
A1014 (dual)	69 060	23 227	33.6	25 818	37.4
A1014 (dual)	68 626	17 122	24.9	19 032	27.7
A1014 (dual)	67 517	11 644	17.2	12 943	19.2
A1014 (single)	18 044	4190	23.2	4657	25.8

Public Transport

15.5.12 There are no bus stops directly serving the A1014 Manorway. The nearest stops are approximately 1.1 km north west of the existing London Gateway site entrance and 4 km from the GEC site.

15.5.13 Less than 3 per cent of the working population travel to work using public transport. The consequence of this limited provision and use is that private vehicle ownership is high. The Office of National Statistics states that approximately 34 per cent of Corringham and Fobbing households have two or more cars or vans. This is compared with 28 per cent for the East of England and 24 per cent nationally.

15.5.14 The majority of people travel to work by private transport (85 per cent) over an average distance of around 12 km.

15.5.15 The nearest railway station to the GEC site is Stanford-le-Hope, approximately 6.3 km east of the GEC site. The railway line that passes through Stanford-le-Hope is a passenger line that runs from Southend Central to Fenchurch Street with services in both directions approximately twice every hour (four per hour during peak times).

Accessibility

15.5.16 The GEC site is remote in terms of neighbouring residential areas and, as such, there is limited scope for walking or cycling to work. The '*Planning Policy Guidance Note 13: Transport*' provides guidance in relation to reasonable walking or cycling distances. The Note states that there is the potential to replace short car journeys by walking, up to 2 km, or cycling, up to 5 km.

15.5.17 The cycling catchment area encompasses parts of Stanford-le-Hope and Corringham; while these are relatively small they do have some potential to provide/house suitably skilled staff to the development during both construction and operation.

15.6 Potential Impacts

Construction

15.6.1 The construction of GEC is expected to commence in 2012. The peak period in terms of on-site construction staff and associated traffic will be early 2014 where 600 personnel per day will travel to and from the site.

15.6.2 The Office of National Statistics states that 78 per cent of people working in Corringham and Fobbing drive to work in a car or van, while 5 per cent travel as a passenger. These figures indicate a person to car/van ratio of around 1.1 for people travelling to work in the area. This figure is considered very low for the nature of the construction work required for GEC. An experiential ratio of approximately 2 persons per vehicle is considered more likely, prior to the implementation of additional schemes for managing traffic volumes.

15.6.3 Construction day will be between 07:00 and 19:00, Monday to Saturday. Therefore, the bulk of the workforce traffic to and from, the site will occur between 06:30 – 08:00 and 18:00 – 19:30.

15.6.4 The peak of construction will require up to approximately 150 HGVs per day. It is anticipated that the HGV movements will be spread evenly over the course of the working day at a rate of around 20 vehicles per hour between 09:00 and 17:00.

15.6.5 From Table 15.4, the most sensitive part of the study area will be the A13, particularly the dual carriageway section where the road capacity is estimated at approximately 3970 vehicles per hour in the busiest direction. The stress of this road, as defined by the ratio of the AADT to the CRF, is approximately 105 per cent; the A1014 Manorway has significantly lower ratios implying more available capacity.

15.6.6 All vehicles will arrive at the London Gateway Gate 3 entrance, travelling eastward, along The Manorway, and depart the site travelling westward. Table 15.5 and Table 15.6 show the one-way background traffic and additional construction traffic for the peak of construction in the affected/busiest direction.

TABLE 15.5: ANTICIPATED TOTAL TRAFFIC (A13 DUAL CARRIAGEWAY)

Hour Ending		*Background (2014)*	*GEC (2014)*	*Total*
07:00	E	1597	300	1897
08:00	W	4027		4027
09:00	W	3764		3764
10:00	E	1945	20	1965
11:00	W	2774	20	2794
12:00	W	2548	20	2568
13:00	E	2443	20	2463
14:00	E	2811	20	2831
15:00	E	3417	20	3437
16:00	E	3808	20	3828
17:00	W	2787	20	2807
18:00	E	4259		4259
19:00	E	3580		3580
20:00	W	1816	300	2116

TABLE 15.6: ANTICIPATED TOTAL TRAFFIC (A13 3-LANE)

Hour Ending		*Background (2014)*	*GEC (2014)*	*Total*
07:00	E	1864	300	2164
08:00	W	4528		4528
09:00	W	4130		4130
10:00	E	2270	20	2290
11:00	W	3119	20	3139
12:00	W	2864	20	2884
13:00	E	2851	20	2871
14:00	E	3280	20	3300
15:00	E	3987	20	4007
16:00	E	4444	20	4464
17:00	W	3133	20	3153
18:00	E	4952		4952
19:00	E	4971		4971
20:00	W	2042	300	2342

15.6.7 As can be seen, the peak construction traffic associated with the construction of GEC will not cause a change in the peak hours experienced by the A13.

15.6.8 The calculations set out in Advice Note TA46/97 indicate that there will be a resulting change in Congestion Reference Flow. Assuming the above arrival/departure profile, the CRF in 2014 will increase to 71 316 vehicles per day (dual carriageway) and 97 206 (3-lane). The CRF is an estimate of the daily capacity that is likely to result in congestion during the peak traffic hours. The CRF is based on the hourly traffic profile, specifically the percentage of the AADT that occurs during the peak hours. The above arrival/departure profile limits the generation of additional traffic to outside these hours and does not increase the maximum hourly traffic volume experienced by the A13. The change in the hourly traffic profile would allow for a greater daily throughput to be sustained.

15.6.9 The current AADTs for the A13 are detailed in Table 15.4. Applying a TEMPRO and NRTF adjustment to these figures, the background AADTs in 2014 are anticipated to be 82 466 and 92 740 vehicles per day. The addition of construction traffic consisting of approximately 450 vehicles per day means that the resulting AADTs at the peak of construction will be 83 237 and 93 511 respectively. These totals are 116.7 and 96.2 per cent of the applicable Congestion Reference Flows and indicate that the road is likely to operate at or above capacity, at the peak of construction.

15.6.10 As previously stated, the CRF is an estimate of the daily capacity that is likely to result in congestion during the peak traffic hours. Table 15.7 and Table 15.8 present an analysis of the performance of the A13, in the affected/busiest direction, against the maximum sustainable hourly lane throughput.

TABLE 15.7: RATIO OF FLOW TO CAPACITY (A13 DUAL CARRIAGEWAY)

Hour Ending		*Background (2014)*	*RFC (%)*	*GEC (2014)*	*Total*	*RFC (%)*
07:00	E	1597	40	300	1897	48
08:00	W	4027	101		4027	101
09:00	W	3764	95		3764	95
10:00	E	1945	49	20	1965	49
11:00	W	2774	70	20	2794	70
12:00	W	2548	64	20	2568	65
13:00	E	2443	62	20	2463	62
14:00	E	2811	71	20	2831	71
15:00	E	3417	86	20	3437	87
16:00	E	3808	96	20	3828	96
17:00	W	2787	70	20	2807	71
18:00	E	4259	107		4259	107
19:00	E	3580	90		3580	90
20:00	W	1816	46	300	2116	53

TABLE 15.8: RATIO OF FLOW TO CAPACITY (A13 3-LANE)

Hour Ending		*Background (2014)*	*RFC (%)*	*GEC (2014)*	*Total*	*RFC (%)*
07:00	E	1864	33	300	2164	38
08:00	W	4528	80		4528	80
09:00	W	4130	73		4130	73
10:00	E	2270	40	20	2290	41
11:00	W	3119	55	20	3139	56
12:00	W	2864	51	20	2884	51
13:00	E	2851	50	20	2871	51
14:00	E	3280	58	20	3300	58
15:00	E	3987	71	20	4007	71
16:00	E	4444	79	20	4464	79
17:00	W	3133	55	20	3153	56
18:00	E	4952	88		4952	88
19:00	E	4971	88		4971	88
20:00	W	2042	36	300	2342	41

15.6.11 Table 15.7 indicates that there is an exceedance of the DfT threshold of 85 per cent for the peak hours (07:00 – 09:00 and 17:00 – 19:00) of the dual carriageway section of the A13. However, this is anticipated to be due to natural traffic growth along the road and it is expected that the construction of the GEC will not generate any vehicle trips during these times. Table 15.7 indicates that there will also be an exceedance of the DfT threshold between 14:00 – 16:00.

15.6.12 Table 15.8 indicates that the 3-lane section of the A13 will operate above the DfT RFC threshold of 85 per cent between 17:00 and 19:00. However, this is also due to natural traffic growth along the road and it is expected that the construction of the GEC will not generate any vehicle trips during these times.

15.6.13 The results in the above tables show that the operational traffic will not cause the A13 to operate above the DfT threshold of satisfactory capacity. Therefore, the impact of traffic associated with the construction of GEC is considered to be insignificant.

15.6.14 Successful application of the proposed mitigation and monitoring schemes prescribed under the Transport Management Plan would ensure that all traffic associated with the construction and operation of the GEC will have an insignificant impact on the local transport infrastructure.

Abnormal Loads

15.6.15 The number of abnormal loads that would be required for the construction will be of the order of 10 to 15 over the entire construction period. The exact number will depend on the final configuration of the plant and will be defined upon completion of the tendering process.

15.6.16 The transport of abnormal loads can lead to disruption or delays and is considered to be of moderate significance.

Operation

15.6.17 GEC will require approximately 40 staff, as a stand alone operation to satisfy the daily operational and maintenance requirements of the plant. Half of these staff will be on-site during normal office hours, with the remainder operating under a five shift (8 to 12 hours) system with up to five on-site at any one time.

15.6.18 A typical five shift system is shown in Table 15.9

TABLE 15.9: CONTINUOUS FIVE SHIFT SYSTEM

Week	Mon	Tues	Wed	Thurs	Fri	Sat	Sun
1	M1	M1	N1	N1			
2	A	A	A		M1	M1	M2
3	N1	N1					
4			M1	M1	N1	N1	N2
5				A	A	A	
Total cover	MAN	MAN	MAN	MAN	MAN	MAN	M2N2

M1 = Morning shift (8 hours) M2 = Morning shift (12 hours) N1 = Night shift (8 hours)
N2 = Night shift (12 hours) A = Afternoon shift = day off

15.6.19 It is anticipated that the morning and afternoon shifts in the above example will require five staff members to be on-site, reducing to four for the night shifts.

15.6.20 Up to an additional 20 indirect staff will be present on site each day for the provision of general site maintenance services, e.g. cleaning and catering.

15.6.21 Traffic associated with the full operation of the Development would be of the order of 60 vehicles per day, each making a return journey. A large proportion of these will be due to staff movements and will, therefore, be predominantly local journeys. The plant will also require the intermittent delivery of various process chemicals

15.6.22 During operation of GEC, it is expected that a maximum of up to 30 vehicles will travel to, or depart, the site at any one time, with the bulk of these representing staff working normal office hours, arriving to site over the hour ending 09:00 and departing over the hour ending 18:00.

15.6.23 The anticipated shift system will generate no more than five staff vehicles on the local road network at any one time.

15.6.24 Table 15.10 and Table 15.11 present the proposed arrival/departure profile for operation of the GEC and an analysis of the performance in the affected/busiest direction against the maximum sustainable hourly lane throughput. The ten vehicles generated between the peak hours will be associated with shift changes at the GEC; the shift system has not yet been defined and could apply to any hour.

TABLE 15.10: RATIO OF FLOW TO CAPACITY (A13 DUAL CARRIAGEWAY)

Hour Ending		*Background (2015)*	*RFC (%)*	*GEC (2015)*	*Total*	*RFC (%)*
07:00	W	4240	107		4240	107
08:00	W	4106	103		4106	103
09:00	E	2574	65	30	2574	65
10:00	W	3276	83	10	3286	83
11:00	W	2829	71		2839	72
12:00	W	2598	65		2608	66
13:00	E	2491	63		2501	63
14:00	E	2866	72		2876	72
15:00	E	3484	88		3494	88
16:00	E	3883	98		3893	98
17:00	E	4327	109		4337	109
18:00	W	3127	79	30	3127	79
19:00	E	3650	92		3650	92
20:00	E	2553	64		2553	64

TABLE 15.11: RATIO OF FLOW TO CAPACITY (A13 3-LANE)

Hour Ending		*Background (2015)*	*RFC (%)*	*GEC (2015)*	*Total*	*RFC (%)*
07:00	W	4768	84		4768	84
08:00	W	4617	82		4617	82
09:00	E	3003	53	30	3003	53
10:00	W	3684	65	10	3694	65
11:00	W	3180	56		3190	57
12:00	W	2921	52		2931	52
13:00	E	2907	51		2917	52
14:00	E	3344	59		3354	59
15:00	E	4065	72		4075	72
16:00	E	4531	80		4541	80
17:00	E	5049	89		5059	90
18:00	W	3516	62	30	3546	63
19:00	E	4260	75		4260	75
20:00	E	2980	53		2980	53

15.6.25 Table 15.10 indicates that there is likely to be a number of exceedances of the DfT threshold of 85 per cent for the busiest direction of the dual carriageway section of the A13. However, this is anticipated to be due to natural traffic growth along the road and it is expected that the vehicle trips associated with the operation of the GEC will be in the opposite direction to the busiest flow, operating below the threshold.

15.6.26 Table 15.11 indicates that the 3-lane section of the A13 will operate above the DfT RFC threshold of 85 per cent between 16:00 and 17:00. However, this is also due to natural traffic growth along the road. The results in the above tables show that the operational traffic will not cause the A13 to operate above the DfT threshold of satisfactory capacity.

15.6.27 In 2015, the CRF for the dual carriageway A13 will be approximately 68 130, with an AADT of approximately 81 000 vehicles per day. The addition of 120 two-way vehicle trips per day represents an increase of 0.2 per cent of the average daily volume, and approximately 0.16 per cent of the future baseline CRF.

15.6.28 Therefore, the impact of traffic associated with the operation of the GEC is considered to be insignificant.

15.6.29 During regular maintenance shutdowns, a further 30 contracted engineering staff may be employed at the GEC site and a maximum of approximately 30 two-way vehicle movements expected.

15.6.30 In addition, during certain major maintenance periods there may be 400 contracted engineering staff on-site, including the permanent and contracted engineering maintenance staff used during regular maintenance shutdowns. These events typically occur once every three years and are expected to last between four and six weeks. Under this scenario, a maximum of approximately 400 two-way vehicle movements are expected. It is considered that the impact of the peak construction traffic (approximately 900 two-way vehicle movements) will be insignificant therefore the impact of the major maintenance traffic is similarly considered to be insignificant.

15.7 Mitigation

Construction

15.7.1 Access to the proposed site will be through the London Gateway Logistics Park. The on-site road infrastructure of the London Gateway development will connect the site entrance, on the west boundary of the GEC site, to the A1014 Manorway and, via the A13, to the M25 motorway.

Transport Management Plan

15.7.2 All vehicle movements associated with the construction of the GEC will operate under a Transport Management Plan (TMP). The purpose of the TMP will be to provide a framework for the active management of all potential issues resulting from the increased demand on the local transport infrastructure to ensure that all impacts are minimised or eliminated.

Key Features

15.7.3 The preparation of a detailed TMP is not practical at present as the project has not yet entered the detailed design stage therefore the exact requirements of the construction have not yet been established. However, the key features of the TMP will be:

Transport Manager
GECL will appoint a Transport Manager to co-ordinate all aspects of transport associated with the construction of the GEC and be responsible for the effective implementation of the TMP.

Definition
Targets and objectives will be set with regard to issues including traffic volumes and the scheduling of deliveries to the site and appropriate procedures and control methods will be established in full consultation with the Highways Agency and Thurrock Council.

Monitoring
GECL will monitor the level of on-site personnel, volumes and timings of vehicles travelling to and from site and the adherence to timetables throughout the construction phase of the project.

Review
The monitoring results will be regularly assessed to evaluate the effectiveness of all strategies defined within the TMP and to anticipate any variance from the targets or key dates within the construction programme.

As part of the review process the Transport Manager will discuss all relevant issues with other users of the London Gateway to establish the scope for the provision of shared traffic management services. These discussions will also help to identify any potentially significant cumulative impacts on the local transport infrastructure and define appropriate mitigating measures that could be mutually beneficial.

Reporting
Regular updates will be provided to the Highways Agency and Thurrock Council as to the performance of the TMP and any issues identified as a result of the review and monitoring.

Update of TMP
The TMP is intended to operate as a working document that will evolve throughout the construction phase. The Transport Manager will ensure that all proposed modifications to the Plan will be discussed and agreed with the Highways Agency and Thurrock Council, in advance and as necessary.

15.7.4 Upon completion of the detailed civil engineering design it will be possible to provide a more accurate assessment of the traffic requirements and local impact of the proposed construction. The TMP will incorporate a Green Travel Plan to encourage the use of sustainable transport methods however this will only be defined once final recruitment/contractor details are known.

15.7.5 All details of the Traffic Management Plan will be fully agreed with the Highways Agency and Thurrock Council within an appropriate timescale and prior to the commencement of any on-site construction work.

Abnormal Loads

15.7.6 Construction contractors will be required to survey all routes to ensure that any abnormal load can be transported to site by road with the least inconvenience to other road users. The contractors will be responsible for the cost of any route strengthening requirements.

15.7.7 The transportation of abnormal loads can lead to disruption and delays. Routes and timings of the transportation of abnormal loads will be discussed with the relevant authorities in order to minimise disruption. A police escort may also be used.

Operation

15.7.8 Traffic associated with the operation of the GEC will have an insignificant effect on the wider road network and thus will require no further mitigation.

15.8 Assessment of Residual Impacts

Construction

15.8.1 Through the active management of the construction site traffic and discussions with the relevant authorities any negative effects, on the local transport network, will be intermittent and temporary.

15.8.2 The local authorities will be notified, well in advance, of the transport of abnormal loads. Full route surveys will be undertaken by the contractor to ensure the structural suitability of any proposed route. All abnormal loads will be moved in accordance with local authority instructions including use of a police escort, where necessary. Full discussion of the potential issues should reduce the significance of these movements from moderate to minor.

15.8.3 Upon completion of the construction and commissioning of the GEC all impacts will reduce to insignificant.

Operation

15.8.4 All operational impacts are predicted to be insignificant.

15.9 Cumulative Impacts

15.9.1 The significant development in the region is the LG Development to redevelop the land of the former oil refinery at Shell Haven. The overall proposals comprise a Business and Logistics Park, and a deep-sea container port adjacent to the commercial development, on the north bank of the River Thames.

15.9.2 Planning applications have been submitted for both developments including Environmental Statements that include assessments of the impacts of the proposals on road transport.

15.9.3 The initial transport assessment for the LG Development was completed in January 2002 and has since been subject to a range of updates and amendments. Data for the traffic generation of both projects has been taken from the 2004 compiled version of the Environmental Statement that accompanied the outline planning application for the LG Development.

Construction

15.9.4 The peak construction traffic of the port and the commercial centre is quoted in the above ES as being 425-500 and 625-725 vehicles per day, respectively, including up to 100 HGVs per development.

15.9.5 It is unclear from the ES when the peak of for the LG Development is anticipated therefore it is assumed in this assessment it will coincide with the peak of construction of the GEC (2014) to provide a worst case assessment. Table 15.12 and Table 15.13 detail the baseline conditions and traffic generation as a result of both the London Gateway and the GEC. The arrival/departure distribution of the LG Development has been assumed based on statements included in the LG Development ESs including:

- The timing of the construction related traffic is likely to be outside the network peak hours
- Work will typically start before the 08:00-09:00 network peak

TABLE 15.12: RATIO OF FLOW TO CAPACITY (A13 DUAL CARRIAGEWAY)

Hour Ending		***Background (2014)***	***London Gateway***	***Total***	***RFC (%)***	***GEC (2014)***	***Total***	***RFC (%)***
07:00	E	1597	410	2007	51	300	2307	58
08:00	E	2441	*815*	3256	82		3256	82
09:00	E	2524		2524	64		2524	64
Mid-Peak	-	3808	*20*	3828	96	*20*	3848	97
17:00	W	2787	*20*	2807	71	*20*	2827	71
18:00	W	3067		3067	77		3067	77
19:00	W	2469	*815*	3284	83		3284	83
20:00	W	1816	*410*	2226	56	*300*	2526	64

TABLE 15.13: RATIO OF FLOW TO CAPACITY (A13 3-LANE)

Hour Ending		***Background (2014)***	***London Gateway***	***Total***	***RFC (%)***	***GEC (2014)***	***Total***	***RFC (%)***
07:00	E	1864	410	2274	40	300	2574	46
08:00	E	2848	815	3663	65		3663	65
09:00	E	2946		2946	52		2946	52
Mid-Peak	-	4444	*20*	4464	79	*20*	4484	79
17:00	W	3133	*20*	3153	56	*20*	3173	56
18:00	W	3448		3448	61		3448	61
19:00	W	2776	*815*	3591	64		3591	64
20:00	W	2042	*410*	2452	43	*300*	2752	49

15.9.6 Table 15.12 indicates that there is an exceedance of the DfT threshold of 85 per cent for the mid-peak hours of the dual carriageway section of the A13. However, this is anticipated to be due to natural traffic growth along the road, as shown in Table 15.7. The results in the above tables show that the construction traffic associated with both the GEC and LG Development will not cause the A13 to operate above the DfT threshold of satisfactory capacity.

15.9.7 In 2014, the CRF for the dual carriageway A13 will be approximately 68 130, with an AADT of approximately 79 500 vehicles per day. The addition of 160 vehicle trips per day represents an increase of approximately 0.2 per cent of the average daily volume, and less than 0.25 per cent of the CRF.

15.9.8 Therefore, the impact of traffic associated with the construction of the GEC and LG Development is considered to be insignificant.

Operation

15.9.9 Operational 24-hour traffic generation data (for full operation in 2016) is presented in Table A21.1.2 of the above ES and displayed in Table 15.14 below.

TABLE 15.14: MASTERPLAN 24-HOUR TRAFFIC GENERATION (2016)

Land use	***Arrivals***	***Departures***	***Total***
Port	5341	5341	10 682
Ro-Ro	908	908	1816
B8	10 549	10 549	21 098
B2	2594	2594	5187
B1(b)/B1(c)	4873	4873	9747
Ancillary	247	247	495
	24 513	***24 513***	***49 025***

15.9.10 Peak hour operational traffic generation by the LG Development is presented in Table A21.1.3 and Table A21.1.4 of the above ES and shown in Table 15.15.

TABLE 15.15: MASTERPLAN PEAK TRAFFIC GENERATION (2016)

	AM Peak (08:00 – 09:00)			***PM Peak (17:00 – 18:00)***		
Land use	***Arrivals***	***Departures***	***Total***	***Arrivals***	***Departures***	***Total***
Port	177	172	349	263	268	531
Ro-Ro	1	0	1	45	198	244
B8	830	499	1329	437	672	1110
B2	407	124	531	130	384	514
B1(b)/B1(c)	674	279	953	282	616	898
Ancillary	53	11	64	12	41	53
	2142	***1085***	***3227***	***1169***	***2180***	***3350***

15.9.11 The target date for commercial operation of the GEC is 2015. However, no further traffic generation information is included in the LG Development ES; therefore, the data in Table 15.15 has been applied to 2015 as a worst case scenario and used in the assessment of each hour in the cumulative analysis presented in Table 15.16 and Table 15.17.

TABLE 15.16: RATIO OF FLOW TO CAPACITY (A13 DUAL CARRIAGEWAY)

Hour Ending		*Background (2015)*	*London Gateway*	*Total*	*RFC (%)*	*GEC (2015)*	*Total*	*RFC (%)*
07:00	E	1629	2142	3771	114		3771	114
08:00	E	2489	2142	4631	140		4631	139
09:00	E	2574	2142	4716	142	20	4736	143
Mid-Peak	-	3883	2180	6063	183	5	6068	183
17:00	W	2841	2180	5021	151		5041	152
18:00	W	3127	2180	5307	160	20	5327	160
19:00	W	2517	2180	4697	142		4697	141
20:00	W	1852	2180	4032	121		4032	121

TABLE 15.17: RATIO OF FLOW TO CAPACITY (A13 3-LANE)

Hour Ending		*Background (2015)*	*London Gateway*	*Total*	*RFC (%)*	*GEC (2015)*	*Total*	*RFC (%)*
07:00	E	1901	2142	4043	84		4043	84
08:00	E	2904	2142	5046	105		5046	105
09:00	E	3003	2142	5145	107	*20*	5165	107
Mid-Peak	-	4531	2180	6711	139	*5*	6716	139
17:00	W	3195	2180	5375	112		5375	111
18:00	W	3516	2180	5696	118	*20*	5716	119
19:00	W	2830	2180	5010	104		5010	104
20:00	W	2082	2180	4262	88		4262	88

15.9.12 As shown in the above tables, the RFC is likely to exceed 85 per cent for almost all daytime hours along the A13 indicating that delays and congestion are likely to increase along the A13 between the M25 and the A1014 Manorway. However, it can be seen that traffic associated with the operation of the GEC will make an almost imperceptible contribution to these exceedances.

SECTION 16

CULTURAL HERITAGE

16 CULTURAL HERITAGE

16.1 Summary

16.1.1 An Archaeological Desk Based Assessment (DBA) has previously been undertaken by PB for GEC. The DBA has been used as the basis for this Cultural Heritage Section of the ES, although additional sources of information have also been consulted. These have included information sources such as: publicly available records; modelling studies; and, previous ES for other developments, including the LG Development.

16.1.2 The south east of England and in particular the River Thames Estuary was occupied extensively in the past and is known to have been important both as a trade route and for settlement from the Prehistoric period onwards. It is likely that the region was also heavily occupied during the Roman, Medieval and Post-Medieval periods.

16.1.3 The proposed GEC site was formally part of the Shell Haven Oil Refinery. Tanks and Refinery equipment were first constructed at the site in the early 20th Century. The site then rapidly developed through the next few decades and historical plans show that by 1960, the entire GEC site and surrounding Landholdings were completely covered by development associated with the Thames Haven Oil Refinery. Oil production slowed down in the latter part of the 20th Century, and between 1999 and 2002 the site was completely cleared of development.

16.1.4 Therefore, despite the heavily developed, industrial heritage of the proposed GEC site, the surrounding area is rich in remains of archaeological and cultural heritage significance.

16.1.5 There are three Scheduled Ancient Monuments (SAM's) within a 5 km radius of the site. These include:

- A heavy anti-aircraft gunsite (Monument No. 32433);
- A World War Two bombing decoy (Monument No. 32445); and,
- The remains of a Roman salt manufactory (Monument No. 32424).

16.1.6 These SAM are discussed further in Sub-Section 16.7 of this Section.

16.1.7 A search of the Essex County Sites and Monuments Record (SMR) has revealed a further eight recorded archaeological sites within a 1 km radius of the GEC site. Six of these sites relate to 20th Century 'modern' archaeology and are associated with World War Two. One of these sites is dated to the Post-Medieval period and the other entry is related to the Medieval Period.

16.1.8 A review of the National Monuments Record (NMR) has indicated a further four entries within 1 km of the GEC site which have been assigned a National Monument Number, but which do not appear in the Essex County SMR. All four entries date from the Post-Medieval period.

16.1.9 No Listed Buildings are recorded within 1 km of the GEC site (Index of Listed Buildings online). However, a total of 13 Listed Buildings have been recorded within a 2.5 km radius of the GEC site. The Listed Buildings are all recorded around the village of Fobbing. 12 of these buildings are Grade 2 Listed and are mainly residential properties. One is a 12th Century Grade 1 Listed church. All buildings are described in more detail in Table 16.4 of this Section.

16.1.10 Previous archaeological investigations were undertaken by Oxford Archaeology Unit (OAU) in 2002, 2003 and 2004 to support the Outline Planning Application for the surrounding LG Business and Logistics Park development. These investigations have revealed further sites of archaeological and cultural heritage significance in the surrounding area of the Thames Haven Landholding (although outside of the 1 km search area from the proposed GEC site). These sites have been referenced in this Section where appropriate and their numbers are prefixed by the letters OAU.

16.1.11 As part of the DBA for GEC, a site walkover survey was undertaken. The site walkover assessment revealed no further archaeological remains on site, or in the immediate vicinity of the site, other than those already reported by documentary sources already reviewed.

16.1.12 The proposed GEC site was potentially occupied during the Prehistoric, Roman and Medieval periods, most likely as agricultural land, or for riverside dwellings associated with the important trade route of the River Thames. A sub-surface deposit model, with 14^{th} Century dating has been undertaken as part of the archaeological investigations for the proposed LG Development. The model has revealed that the site experienced periodic flooding from the rising and falling level of the Thames, throughout its history. Hence, the drier periods would have supported development, the remains of which would then subsequently been preserved by rising flood waters.

16.1.13 There is the possibility of impacting upon and surviving buried remains of archaeological and palaeoecological importance, particularly through the excavation of foundations for large buildings. Despite this, the former development of the site and the high levels of contamination found underlying the site means that any remains of archaeological or palaeoecological significance underlying the site are likely to have been impacted significantly and their safe excavation may not be possible.

16.1.14 It has been concluded that there is no potential of impacting upon any SAM, Listed Buildings or upstanding remains of cultural heritage significance, due mainly to their significant distance from the GEC site and their listing for architectural preservation rather than historical landscape setting.

16.1.15 The proposed GEC development will therefore not impact upon any Monuments or remains of either archaeological or cultural heritage significance either on site or in the immediate vicinity of the site.

16.2 Introduction

16.2.1 This Section of the ES provides an assessment of the existing archaeological and cultural heritage assets of the proposed GEC site and surrounding area and the potential impact that the development may have on these resources.

16.2.2 The objectives of this assessment are to:

- Describe the survival and extent of known or potential archaeological features, which may be disturbed by the proposed development;
- Provide and assessment of the importance of these assets;
- Assess the likely scale of any impacts on the archaeological and cultural heritage resource posed by the development;
- Outline suitable mitigation measures to avoid, reduce or remedy significant adverse effects; and
- Provide an assessment of any residual effects remaining after mitigation.

16.2.3 This section of the ES has been completed with detailed reference to an archaeological DBA undertaken for the GEC site by PB in January 2010. A walk-over survey was also made as part of the assessment which noted site topography, earthworks, services, boundaries, buildings and any remains of archaeological or cultural heritage significance not already recorded by other sources.

16.3 Key Planning Policies

16.3.1 Section 3 provides the planning policy content. The policies listed below have informed the assessment process, to which reference has been made in Section 3. A full transcript of these policies is contained in Volume 2 Appendix A.

East of England Plan

C1	Cultural Heritage
ENV6	The Historic Environment
ETG1	Strategy for the Sub Region

16.4 Assessment Methodology and Significance Criteria

Assessment Methodology

16.4.1 A Desktop Study of documentary, photographic and cartographic sources has been undertaken in order to determine the likely nature, extent, importance and state of preservation of any archaeological remains that may be present within the area of proposed development. In particular, the examination of historical maps has revealed the dates and extent of the former Thames Haven Oil Refinery Development, which may have impacted the survival of these remains.

16.4.2 The following studies have been referenced in this Section of the ES. The proposed GEC is situated on land within the LG Development landholding.

- Archaeological Desk Based Assessment compiled for the proposed GEC development, undertaken by Parsons Brinckerhoff Limited (2010);
- Environmental Statement compiled for an Outline Planning Application for the development of the LG Logistics and Business Park (2004);
- Archaeological monitoring of contamination test pits at the former Thames Haven Oil Refinery site (February and March 2001);
- Site walkover at the Thames Haven Oil Refinery site (August 2001 and October 2002);
- Subsurface Deposit Model (October 2001);
- Assessment of past effects within the former Shell Haven Oil Refinery (October 2002 – February 2003); and
- Listed Building and Conservation Area Technical Report (March 2003).

Significance Criteria

16.4.3 Determining the magnitude of any potential significant impact on the archaeological resource is based on an understanding of how and to what extent the proposed development would impact on archaeological assets of international, national, regional, local or negligible importance.

16.4.4 Any potential impacts of the proposed development on archaeological remains are rated as high, moderate, low, negligible or uncertain, depending on both the magnitude of the change and the sensitivity of the receptor.

16.4.5 The following matrices (Table 16.1 to Table 16.3) set out the criteria for assessing the magnitude of impacts on archaeological resources of varying degrees of value. Care has been taken to ensure that these matrices are consistent with the assessment approach undertaken in previous ES which covered the surrounding LG Development.

TABLE 16.1 CRITERIA FOR ESTABLISHING RELATIVE CULTURAL VALUE

Cultural Value	*Criteria*
International	• World Heritage Sites • Iconic Sites and Monuments • Some Scheduled Ancient Monuments
National	• Some Scheduled Ancient Monuments • All Grade 1 and some Grade 2* and Grade 2 Listed Buildings • English Heritage Registered Parks and Gardens
Regional	• Some Grade 2 and 2* Listed Buildings • Remains of national importance which have been partially damaged • Historic (unlisted) buildings that have exceptional qualities in their fabric or historical associations • Conservation Areas containing buildings that contribute significantly to its historic character
Local	• Archaeological sites and remains which are of low potential or minor importance • Historic (unlisted) buildings of modest quality in their fabric or historical association • Crop marks of indeterminate origin • Remains of regional importance that have been partially damaged or remains of national importance which have been substantially damaged. • Sites which contribute to local or cultural understanding of the area
Negligible	• Relatively numerous types of remains, of some local importance. • Remains of local importance that have been largely damaged. • Isolated findspots with no context • Areas in which investigative techniques have revealed no, or minimal, evidence of archaeological remains, or where previous large scale disturbance or removal of deposits can be demonstrated
Uncertain	• Potential archaeological sites for which there is little information. It may not be possible to determine the importance of the site based on current knowledge. Such sites are likely isolated findspots or cropmarks only identified on aerial photographs.

TABLE 16.2: CRITERIA FOR CLASSIFYING MAGNITUDE OF PHYSICAL IMPACT

Impact	***Criteria***
High	• Complete removal of an archaeological site • Severe transformation of the setting or context of an archaeological monument or significant loss of key components in a monument group • Complete removal or transformation of palaeo-environmental deposits leading to complete loss of research knowledge • Direct and substantial visual impact on a significant sightline to or from a ritual monument or prominent fort
Moderate	• Removal of a major part of an archaeological site • Potential transformation of the setting or context of an archaeological site or partial loss of key components in a monument group. • Partial removal or transformation of palaeo-environmental deposits • Introduction of significant noise, vibration or visual impact to an archaeological monument leading to changes in amenity use, accessibility or appreciation of an archaeological site. • Oblique visual impact on an axis adjacent to a significant sightline to or from a ritual monument, but where the significant sightline of the monument is not obscured
Low	• Removal of an archaeological site where a minor part of its total area is removed, but the site still retains a significant future research potential • Minor removal of palaeo-environmental deposit • Change to a historic building or feature, resulting in a small change in the resource and its historical context and setting • Peripheral visual impact on a significant sightline to or from a ritual monument
Negligible	• No perceptible change in the setting, context or physical impact to a building or feature • No impact on changes in use, amenity or access • No real change in the ability to understand and appreciate the resource and its historical context and setting
Uncertain	• The magnitude of the impact cannot be predicted

TABLE 16.3: METHOD OF RATING OVERALL SIGNIFICANCE OF IMPACT ON ARCHAEOLOGICAL / ARCHITECTURAL HERITAGE SITES BY THE PROPOSED DEVELOPMENT

		Cultural Value					
		Uncertain	***Negligible***	***Local***	***Regional***	***National***	***International***
Magnitude of Impact	***High***	Unknown	Low	Moderate	Major	Major	Major
	Moderate	Unknown	Low	Low	Moderate	Major	Major
	Low	Unknown	Negligible	Low	Low / Moderate	Moderate / Major	Major
	Negligible	Unknown	Negligible	Negligible	Low	Moderate	Moderate
	Uncertain	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

16.5 Baseline Conditions and Receptors

Geology

16.5.1 BGS 1:50,000 Series Sheets 258 and 259, Southend and Foulness (Solid and Drift Editions) indicate that the superficial geology across the site comprises made ground, overlying marine or estuarine alluvium (undifferentiated or clay) overlying solid geology of Lower London Tertiaries. These Tertiaries comprise Woolwich beds (greenish yellow fine sand with frequent shell beds), Oldhaven Beds (firm yellow to buff fine sand) and Thanet Beds (predominantly silty fine sand). Upper chalk deposits are anticipated to underlie the site at significant depth.

16.5.2 This geological sequence has also been largely confirmed by intrusive investigations undertaken at the site by ERM Limited (2000) and Fugro Limited (2008). These ground investigations recorded made ground overlying drift deposits of marine / estuarine alluvium and sand and gravels overlying deposits of stiff London Clay. The clay deposits were found to overlie Woolwich and Thanet beds comprising interbedded fine sand, silt and clay with subordinate gravel beds. Made ground deposits were often found to be contaminated.

Topography

16.5.3 The site is predominantly flat and low-lying at approximately 2.1 m AOD.

Sub-Surface Deposit Model

16.5.4 The sub-surface deposit model, undertaken for the proposed LG Development has revealed that the proposed GEC site would have experienced up to five periodic episodes of flooding and subsequent drying out, as a result of marine transgressions and regressions. These changes in sea and river levels are responsible for the (often stratified) alluvial silts, which underlie the site.

16.5.5 The deposit model also indicates that there are deposits of organic remains and peats underlying the areas of the LG Development land, which were flooded. Although these deposits have not been recorded by intrusive geotechnical or geoenvironmental boreholes carried out at the proposed GEC site, it possible that some localised deposits do underlie the site at depth.

16.6 Archaeological Potential at the Site

Prehistoric

16.6.1 There is little evidence for prehistoric archaeology within the site or 1 km surrounding area. No documentary or cartographic evidence of this period could be attained and hence research was limited to SMR or NMR entries.

16.6.2 Other archaeological reports undertaken for the LG Development (see Sub-Section 16.4) have identified that the site of the former Thames Haven Oil Refinery (including the proposed GEC site) has a high potential of having supported human occupation from the prehistoric period onwards. Of particular importance is thought to be a sequence of buried landscapes within the layers of alluvium and gravel underlying the site, as discovered by the sub-surface modelling study (OAU, 2001). The earliest evidence for human occupation in the south east of England comes in the form of flint tools dated to approximately 440 000 BC, found in Hillingdon in West London. However, continuous occupation of the Thames Valley probably didn’t occur until much later (approximately 13 000 BC) when changes in climate and land cover would have been more favourable to settlement. Several sources have sited evidence for occupation of the Thames Valley in the Palaeolithic. In particular, gravels in the River Thames Estuary at Purfleet and Grays have yielded many finds of Palaeolithic flint tools.

16.6.3 Although no prehistoric finds are detailed within the proposed GEC site, the following prehistoric tools have been found within the surrounding LG Development landholding and are recorded by OAU Ltd.

16.6.4 A watching brief, undertaken during the development of the Coryton Bypass revealed a Palaeolithic scraper (site OAU71) approximately 2 km north west of the proposed GEC site. A large number of Palaeolithic implements were also found in a gravel pit in Mucking in the 19th Century, approximately 4.5 km from the proposed GEC site.

16.6.5 In the early Mesolithic period, sea levels fell (OAU sub-surface deposit model 2001) and land at the proposed GEC site would have been more favourable to occupation as it would have been covered in dry, dense forest close to the River Thames. Mesolithic flints have been found on several occasions during quarrying approximately 1 km north of the LG Development site (Findspots OAU75, OAU76, OAU78 and OAU79).

16.6.6 It is likely that by the Neolithic period (4 000 BC), the GEC site was submerged under rising sea and river levels. However, some areas of higher ground to the north of the site, identified as the gravel terrace in the sub-surface deposit model, did support occupation. Three flint axes, assumed to be from the Neolithic were discovered during a watching brief in the north of the site. Neolithic flint axes have also been found 500 m and 1 km to the west of the site (OAU 25 and OAU17 respectively), 300 m to the north (OAU75 and OAU76) and 1 km to the north (OAU80). To the west of the LG Development land, evidence of Neolithic activity in the form of pits, pottery and flint has been found at Mucking and West Thurrock. This evidence of occupation shows that by the Neolithic there was most likely continuous occupation of the area. The alluvial, waterlogged deposits underlying the site may therefore preserve organic remains such as palaeoecological indicators of occupation.

16.6.7 During the Bronze Age, London would have started to grow as an important economic centre for the trade and production of metal objects. Bronze Age artefacts found within the proposed LG Development land include: a flint implement found in the north west of the former Thames Haven Oil Refinery in 1970 (OAU38); a Bronze Age flint implement found in the northern part of the Thames Haven Oil Refinery (OAU71); and, a cropmark of a possible Bronze Age ring ditch (OAU39). Crop marks and ring ditches thought to date from the Bronze Age have also been discovered immediately to the south west of the Thames Haven Landholding near Mucking.

16.6.8 Iron Age occupation of the site is likely to have been more extensive than in the Bronze Age due to the more settled groups. For example, evidence of Iron Age occupation has been found 1.5 km to the south west of the site (OAU1). Iron Age pottery has also been found in a gravel pit 500 m south west of the Thames Haven Oil Refinery site (OAU8) and a shard of Iron Age pottery was found 500 m west of the Thames Haven Oil Refinery site in 1970 (OAU18).

Roman

16.6.9 The south east of England, and in particular London and the Thames Valley are known to have been extensively occupied during the Roman period, as the area was strategically placed with excellent links to the continent and was already becoming a large, established trade centre in the late Bronze Age and early Iron Age. London quickly grew in size during the Roman occupation and was later established as the provincial capital in Roman Britain's communication system. Riverside development also increased substantially during the Roman period, suggesting that the River Thames increased in importance as a trade route.

16.6.10 Although no Roman remains have been found within the proposed GEC site, six known sites and findspots dating from the Roman period have been discovered within the LG Development landholding, including the following:

- Five findspots of Roman Pottery, found by chance on the foreshore of Mucking mudflats (OAU10, OAU43, OAU44, OAU45 and OAU48); and
- Evidence of salt making in the form of a Roman Saltern (described in more detail in below).

16.6.11 Roman burials have also been found 1 km to the west of the LG Development landholding (OAU6, OAU24, OAU26, OAU27) and 1 km to the north (OAU74). Pottery, brick, wood and animal bones have been recovered from a flint-lined pit 200 m west of the Thames Haven Oil Refinery landholding (OAU9). Roman pottery has also been found immediately to the north of the development area (OAU63 and OAU64). A number of finds of Roman pottery have also been discovered between 500 m to 1 km west of the proposed development site (OAU2, OAU4, OAU18 and OAU10) and 1 km to the north (OAU76 and OAU77).

Medieval

16.6.12 London and the surrounding area would have continued as an important commercial centre in the Medieval period. Despite this, no Medieval remains have been found within the proposed GEC site or surrounding LG Development landholding. Previous investigations by OAU have identified Medieval remains slightly further a field, including the findspot of Medieval pottery, approximately 1 km to the west and 1 km to the north of the LG Development landholding (OAU 24, OAU78 and OAU80), and a Medieval beaker discovered in a gravel pit near Stanford-le-Hope (OAU26). The Church of St. Margaret of Antioch in Stanford-le-Hope dates from the 12th and 14th Centuries, indicating the presence of an organised settlement here at least. It is also possible that the fertile banks of the River Thames were important for pasture and arable land. By the 14th Century, sea level rise had caused tenants of much of the land on the banks of the River Thames to construct sea defences. It is possible that defences were constructed around the southern boundary of the GEC site at this point, in order to create fertile farmland free from the risk of flooding.

16.6.13 'Old Hall' (HER No. 35361) approximately 2.7 km from the proposed GEC site was built in the 16th Century. However, it was constructed on foundations of an earlier building, dating from the 15th Century. Old Hall is mentioned in the SMR and also in the Essex HER.

16.6.14 The site of Oozedam House is recorded on the Essex HER (HER No. 45737), approximately 1.5 km north of the proposed GEC site and is shown on maps from 1872. Oozedam House is raised above the surface of the marsh and was probably done so to prevent it being destroyed by floods. Oozedam House is thought to date from Medieval times originally, but was then modified during the Post-Medieval and Tudor periods.

16.6.15 An area of Medieval activity was also discovered in the west of the Thames Haven Oil Refinery land during a watching brief on the excavation of a gas pipeline route in 2001, approximately 2 km from the proposed GEC site. Evidence of Medieval occupation includes: burnt material; floor surfaces; pottery; carved animal bone; postholes and gullies; a kiln; an enclosure; and, several boundary ditches. It is possible that these finds may represent a large Medieval settlement, only part of which was recorded by the limited extent of excavations undertaken as part of the pipeline project.

Post Medieval / Modern

16.6.16 The first available OS Map of 1872 shows raised banks crossing the marshes on the north bank of the River Thames. It is likely that these banks would have been used for protection against flooding from the sea. They also serve as boundaries in places and by the post medieval period there are clearly defined parcels of land on the Corringham and Fobbing Marshes. The OS Map of 1872 shows no development on the proposed GEC site. Two watercourses appear to be present on site and converge into the Rugwart Fleet (a tributary of the River Thames) in the south of the site. Several developments are shown within the wider LG Development landholding, including a railway track running immediately south of the CCGT site, which runs to the Thames Haven Dock (with associated Railway Station and Dockhouse) approximately 500 m south east of the GEC site. Oil Mill Farm is shown 500 m north east of the site and Mucking Lighthouse is shown approximately 900 m to the south west. The majority of these buildings no longer exist, although some of their foundations may still be present underground.

16.6.17 An early form of small scale industry on the Thames Marshes was the production of salt. This practice was probably started during Roman times (see reference to Scheduled Monument No. 32424 below). However, it seems to be much more widespread in the early 20th Century, with saltings shown approximately 1 km east of the GEC site on maps dating from 1910 and 1924. The crushing of locally grown flax to produce linseed oil was also undertaken on marshes surrounding the GEC site, and it is this process which probably lends its name to Oil Mill Farm, which is shown on OS Maps from 1872 - 1938 approximately 500 m north east of the GEC site.

16.6.18 In 1838 works were started on the Thames Haven Dock. As part of the dock construction, two rows of cottages were built for the workforce, as no suitable housing existed in the area (LG Business and Logistics Park OPA Environmental Statement, 2004). However, the cottages are not shown on maps from 1872 and therefore may have been demolished by then. The construction of the Thames Haven Dock was thwarted by money issues and was stopped several times and never completed (although it is labelled on the 1872 Map). However, a railway line, built to support the dock was completed and is shown on the OS Map of 1872. It runs east-west through the Thames Haven Oil Refinery landholding, down to a station and pier. Adjacent to the east siding of the station were a set of cattle pens and a cattle holding area. The railway is labelled on OS Maps as the Thames Haven Branch of the London, Tilbury and Southend Railway.

16.6.19 The railway was not only used to transport passengers, but also for importing cattle, which had been shipped in from the continent and delivered to Thames Haven port. Between 1864 and 1866 cattle imports peaked in activity. In 1866 the Thames Haven Company was established and the construction of a new pier, steam trains, cattle pens and other buildings were introduced in the vicinity of the port, approximately 500 m from the GEC site. However, due to outbreaks of disease in cattle and subsequent government legislation, the cattle trade at Thames Haven suffered and the company was eventually wound up in 1884. The railway company still used Thames Haven for importing cattle after this date, on a smaller scale than before, but further outbreaks of disease meant that the cattle importation business was finally stopped altogether in 1895. Cattle pens are however still shown on OS Maps of 1898.

16.6.20 Very little evidence of the cattle importation infrastructure still exists at the site, although the railway line is still present in situ.

16.6.21 Further industrialisation of the site occurred in the latter part of the 19th Century with the construction of the Miners Safety Explosives Factory, which was subsequently taken over and expanded as the Kynoch explosives factory. Both the OS Maps of 1898 and 1924 show the explosives factory as several widely spaced buildings in the western part of Curry Marsh, approximately 5 km from the proposed GEC site. The buildings are connected by a small rail track which was probably used to transport the explosives. The explosives factory closed in 1927 and remained vacant until it was incorporated into the Thames Haven Oil Refinery in the 1960s.

16.6.22 Due to the lack of housing and amenities in the area surrounding the explosives plant, a small village, named Kynochtown (after the company that owned the factory) was built close by for the workers. The first few houses were built in 1897 and the village rapidly grew to more than 40 houses, a school, an institute and a shop, all of which are shown on the 1924 OS Map, approximately 750 m east of the proposed GEC site. In order to transport more workers to the explosives plant from Corringham and Fobbing, the Corringham Light Railway was opened in 1901. The railway line is shown on OS Maps of 1924 to pass approximately 500 m north of the proposed GEC site. A line was also constructed which linked to the Thames Haven Branch of the London, Tilbury and Southend Railway.

16.6.23 In the 1920's the larger Kynochtown explosives plant closed. At around this time land at the plant was taken over by the Cory Brothers, who constructed a large Oil Refinery at the plant and re-named Kynochtown Coryton. Coryton is first shown on OS Maps from 1938 approximately 750 m east of the GEC site.

16.6.24 In 1876 the first small oil storage installation was built at the Thames Haven Oil Refinery site by the Petroleum Storage Company (PSC). Although the PSC experienced financial difficulties and was wound up in 1881, the site was subsequently taken over by a number of companies, including the London and Thames Haven Petroleum Wharf Limited and the London and Thames Haven Oil Wharves Limited (LATHOL). The Thames Haven Petroleum Wharf is first shown on OS Maps of 1898, approximately 250 m south of the proposed GEC site.

16.6.25 During the early 1900's the oil storage depot expanded significantly. Boosted by this rapid expansion, the depot quickly developed a monopoly on the London oil trade. By the outbreak of the First World War there was reported to be a relatively extensive network of pipelines, pump houses and storage buildings, which handled some 400 000 tonnes of refined products per year. Further expansions of the LATHOL site occurred in 1911 when they purchased a refinery owned by The European Petroleum Company and again in 1914 when they purchased a large area of land to the north of Rugwart Fleet. A further oil refinery was developed at the Thames Haven site in 1911 by the Anglo Saxon Petroleum Company (owned by Shell). The Anglo Saxon development included piers, a tank farm and a refinery. The site became known as Shell Haven soon after development.

16.6.26 Evidence of significant expansion of the oil refinement and storage capacity in the study area is shown on OS Maps of 1924. Where the 1910 OS Map showed approximately 12 storage tanks to the south of the GEC site, the 1924 OS Map shows approximately 40 to 50 storage tanks. 21 further tanks are shown in the south east corner of the GEC site, as are several small buildings and a water tower. A further 20 tanks are shown immediately to the west of the GEC site.

16.6.27 The Shell Haven Oil Refinery development expanded substantially in the inter-war period. However, this is not shown on the 1938 OS Map or historical aerial photographs of 1947. It is possible that this is for reasons of national security, as the large oil depot would have provided a perfect target for bombing operations during World War 2.

World War 2 and Later

16.6.28 During World War 2, all of the refinery plants in the Thames Haven Landholding expanded significantly, due to the trend towards refining oil in the UK rather than relying on pre-refined products from abroad. Increased wartime demand also led to the construction of a new unit at the shell plant for the production of paraffin waxes and bitumen. Post-War, the Shell Haven Oil Refinery expanded even further, into an area to the north west of the LATHOL plant. A number of new units were developed on this land including a cooling water pump house, a distillation plant, a boiler plant and a doctor treater. Gradually, the LATHOL and Shell Haven Oil Refineries started to work together more closely and finally, in 1969, Shell took over operation at the LATHOL site. The 1960 OS Map shows a massive expansion of oil tanks and associated buildings on the Shell / Thames Haven landholding. The proposed GEC site is shown to be almost entirely covered in oil storage tanks, as is land immediately south and west. A further network of oil storage tanks, buildings and developments associated with the oil industry is also present between 500 m to 1 km east of the site. The OS Map of 1968 shows further expansion of the plant, with another 28 storage tanks immediately north east of the GEC site. OS Maps from 1976 show no further development to the oil storage depots. The OS Map of 1999 shows the Shell Haven Oil Refinery has scaled down operations, and almost all of the GEC site has been cleared of tanks and overground structures. OS Maps from 2006 and 2009 show the GEC site and almost all of the Thames Haven landholding have been cleared of development.

16.6.29 During World War 2, the proposed GECT site and surrounding area also supported numerous defences to protect the oil refineries from bombing raids. These defences include anti-aircraft ditches 50 m east of the site (HER Entry 14771), 200 m north of the site (HER Entry 14772) and 1 km north west of the site (HER Entry 14763). The site of a World War 2 Pillbox (HER Entry 10329) is recorded 1 km west of the site. The site of a World War 2 bomb crater (HER Entry 172277) is recorded approximately 1 km north of the site.

Scheduled Ancient Monuments

16.6.30 There are three Scheduled Ancient Monuments (SAM's) within a 5 km radius of the GEC site. A larger 5 km study area was selected by the DBA to search for SAM given their potential significance and the greater potential of any development to have an adverse effect on their setting.

16.6.31 These SAM are described below and their position shown in appendices within the Archaeological DBA (included in Volume 2, Appendix E). Descriptions are taken from official records of the monuments, taken from English Heritage:

Heavy Anti-Aircraft Gunsite

16.6.32 This is situated 380 m east of Northwick Farm and approximately 3.5 km north east of the proposed CCGT site (National Monument No. (NMR) 32433).

16.6.33 The SAM lies within 3 areas of protection:

1. The gun emplacements, the command post, the site magazine gunstore and an associated section of the military service road.
2. The sewage disposal unit related to the battery accommodation – situated 150 m east of the gun emplacements.
3. The pump house – situated 150 m south of the sewage disposal unit.

16.6.34 The site was originally designed for the operation of four anti-aircraft guns. Three of the gun stands still stand, but the fourth is thought to be buried beneath a mound. The gun emplacements are constructed to a known design, the 'March 1938 Pattern', and are arranged in an arc with the apex facing towards the usual direction of German aircraft. The three remaining emplacements each contain six internal recesses built into the internal faces of the surrounding walls. The remaining sides of each unit were originally fitted with steel gates which could be opened to allow the movement of guns. The on site magazine bunker, a bomb proof rectangular building, lies between the two northernmost gun emplacements. A 2nd, unroofed rectangular structure (the gunsite command post) occupies the central position within the arc of gun emplacements, accompanied by the generator building, which housed the power supply for the guns and locational equipment. The gun store (a concrete, garage like structure lies some 50 m south of the emplacements, to the east of the service road and north of the accommodation huts for the garrison. 11 of these brick built huts remain in use a light industrial premises.

16.6.35 English Heritage states that surviving examples of gunsites are sufficiently rare to suggest that they are of national importance.

World War 2 Bombing Decoys on the Fobbing Marshes

16.6.36 This is situated approximately 1.9 km north of the proposed GEC site. NMR No. 32445

16.6.37 The remaining upstanding remains at the site consist of the night shelter and oil storage bay of a World War 2 oil decoy, designed to protect the Shell Haven Oil Refinery from German bombing raids. Essentially, the decoys consisted of setting light to large pools of oil, which served two purposes. The first was to act as a decoy so it appeared as if the area had already been bombed. German raids would then avoid the target as they would not want to waste extra ammunition. The fires would also act as a screen of flames and smoke which would prevent German pilots from seeing the extent of the Oil Refinery.

16.6.38 The night shelter would have been occupied by the person responsible for igniting and maintaining the fires. The shelter is 6 m long, 3.2 m wide and aligned north-south, with a single sloping entrance on its northern side. Inside the night shelter are two rooms: the operations room; and, the engine room. There are also two steel connection pipes which probably contained the wiring terminals for electrical ignition of the decoy devices. Approximately 17 m to the west of the night shelter are four parallel walls on heavy concrete foundations. These are probably the remains of six storage bays for drums of oil used in operation of the site.

16.6.39 English Heritage has identified these remains as being of national importance as they are of great significance to the study of bombing decoy design.

Remains of a Roman Saltern and Boat

16.6.40 This is situated approximately 5 km north east of the proposed GEC site. NMR No. 32424)

16.6.41 The monument is situated on low-lying ground near to the Dutch Village in the western half of Canvey Island. The site includes the remains of a Roman Salt Manufactory - visible as a series of earthworks and associated buried remains. The principle feature of the saltern is a substantial mound, approximately 60 m in diameter and up to 1.1 m high. A smaller mound is situated adjacent to the large mound and measures approximately 15 m in diameter. Small scale excavations around the site in 1972 showed the original extent of the hill to be some 100 m in diameter and approximately 3.5 m above Roman ground level.

16.6.42 Medieval re-use of the salt works was also evident, in the form of several other, less pronounced earthworks. Salt was an expensive commodity from Roman-Medieval times and water from natural salt springs or the banks of the River Thames Estuary would have been evaporated over fires, leaving deposits of salt in earthenware pots.

16.6.43 Although salterns are shown on later OS Maps of 1910 and 1924, it is likely that salt production on a large scale stopped altogether in the 17th Century due to the production of rock salt which used far cheaper and less labour intensive practices.

16.6.44 English Heritage has stated that remains of salterns are nationally very rare. There were approximately 300 salterns in Essex, of which very few still survive. Finds associated with salterns include settling tanks, hearths, flues, fire floors and briquetage.

Listed Buildings

16.6.45 A total of 13 Listed Buildings have been found within 2.5 km of the GEC site. A larger 2 km study area was selected by the Archaeological DBA to search for Listed Buildings given their potential significance and the greater potential to have an adverse effect on their setting (particularly through visual and impacts). Table 16.4 summarises these Listed Buildings.

TABLE 16.4 LISTED BUILDINGS WITHIN A 2.5 KM RADIUS OF THE PROPOSED GEC SITE

Name	***Location (relative to the GEC site)***	***Description***	***Potentially Impacted by the GEC Development***
Walnut Tree Cottages	Fobbing road, Fobbing, 2km north west	Pair of 18th Century, 2 storey cottages – Grade 2 Listed.	No – Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.
1 and 2 Lion Hill.	Lion Hill, Fobbing, 2.4 km north west	Late 16th Century 1 storey house. Grade 2 Listed.	No - Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.
White Lion public House.	Lion Hill, Fobbing, 2.4 km north west	Late C14 or early C15 2 storey house, extensively altered. Grade 2 Listed.	No - Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.
1 and 2 Paynes Cottages	High Road, Fobbing, 2.5 km north west	Late 17th Century pair of 2 storey cottages. Grade 2 Listed.	No - Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.
Curtis Cottages	High Road, Fobbing, 2.5 km north west	18th Century House in Plastered Brick. Grade 2 Listed.	No- Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.
Prosbus Hall	High Road, Fobbing, 2.5 km north west	Early 18th Century house with a 16th century wing. Grade 2 Listed.	No - Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.
Granary at Curtis Farm	High Road, Fobbing, 2.5 km north west	18th Century timber framed building. Grade 2 Listed	No - Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.
Barn at Curtis Farm	High Road, Fobbing, 2.5 km north west	18th Century timber framed building. Grade 2 Listed	No - Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.

Pell House	High road, Fobbing, 2.5 km north west	Late C17 house, with possibly earlier origins. Grade 2 Listed	No - Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.
Church of St Michael.	High Road, Fobbing, 2.5 km north west	11th Century church with extensive alterations in the 14th and 15th Centuries. A prominent site overlooking the Thames Marshes. Grade 1 Listed	No. Although the church was originally built with a commanding view over the marshes, the view between the GEC site and the church has since been blocked by developments around Fobbing and developments associated with the Thames Haven Oil Refinery. Additionally, the view will also be hampered by natural topography. The A1014 (The Manorway) Road is located between the GEC site and the church, further limiting views and an appreciation of the historic setting.
Hillcrest Cottages	Wharf Road, Fobbing, 2.1 km north west	Late 16th Century 2 storey house, with additions in the 17th Century. Grade 2 Listed.	No - Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.
Ship Cottages	Wharf Road, Fobbing, 2.1 km north west	Large 15th Century house which is now a group of cottages. Modifies in the 16th and 18th Centuries. Grade 2 Listed.	No - Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.
Fobbing Hall	Wharf Road, Fobbing, 2.1 km north west	16th Century, timber framed 2 storey house. Grade 2 Listed.	No - Distance from the site means that construction activities will not impact. Additionally, listing is for architectural type rather than historical setting.

Site Walkover

16.6.46 A site walkover was also conducted as part of the Archaeological DBA. The aim of the site walkover was to identify any potential archaeological remains present on the GEC site which have not been previously recorded by excavations, the National Monuments Record or the Historic Environment Record. Site topography was noted, as were any areas of exposed geology and soils. Particular attention was paid to patterns and distribution of spoil mounds, changes in vegetation or any other interesting features. A photographic record of the site was conducted and a sketch of the site was drawn to record any interesting features.

16.6.47 The site walkover did not reveal any remains of archaeological or cultural heritage significance which had not been previously recorded by other sources.

16.7 Potential Impacts

Construction

16.7.1 The excavation of building foundations and the construction of site access tracks and ancillary structures all have the potential to directly impact on buried archaeology, both known and unknown. In terms of upstanding remains of archaeological and cultural heritage significance, impacts are likely to be more indirect and related to changes in the cultural and historical settings of monuments as well as visual impacts (views to and from upstanding remains) and noise impacts from construction activities.

16.7.2 In summary, the evidence shown in the Archaeological DBA undertaken for GEC, as well as other documents referenced in this Section (e.g. the sub-surface deposit model (OAU 2001)), has indicated that the proposed GEC site has the potential to support buried archaeological remains from the Prehistoric to the Medieval period. London and the banks of the River Thames are known to have been important centres for occupation and trade.

16.7.3 In addition, it is likely that the GEC site would have experienced periodic flooding throughout its history, leaving fertile agricultural land during dry periods and preserving remains in waterlogged soils during wet periods. The sub-surface deposit model has indicated that there may be peat deposits underlying the GEC site. Any such deposits would have the potential to preserve palaeoecological remains, which may be valuable in reconstructing past environments.

16.7.4 Despite this, historical OS Maps from 1924 to 1999 show the proposed GEC site completely covered in development associated with the former Shell Haven Oil Refinery. It is therefore likely that foundations from these storage tanks and associated buildings will have severely impacted on any underlying remains.

16.7.5 In addition, previous site investigations have noted that made ground which overlies the site is significantly contaminated, especially with hydrocarbons from the former oil refinery. This level of contamination may impact upon the ability to recover archaeological remains in the following ways:

- High levels of contaminants such as sulphates may attack concrete, wood or metal, therefore limiting the potential to recover any meaningful remains;
- High levels of contamination are likely to limit the potential to recover or record any remains safely; and
- Any contamination remediation strategy is likely to involve the excavation of large amounts of soil, therefore potentially destroying any archaeological remains.

16.7.6 In addition to the historic use of the land as part of the Shell Haven Oil Refinery, it is known that the site was also used as a registered landfill site by Shell. This use of the land also has the potential to impact on archaeological remains underlying the site.

16.7.7 Taking the abovementioned points into consideration, there is considered to be a low potential of impacting on receptors of Local Significance. The overall significance of impact for the construction period (without mitigation) on buried archaeology is therefore considered to be Low and Not Significant.

16.7.8 A World War 2 bombing decoy is the closest SAM to the site (approximately 1.9 km to the north). The attribute importance of the SAM has been assessed as being of National Value because of its SAM status and description from English Heritage. Despite this, there are not anticipated to be any impacts on this SAM during construction. Views to the construction site from the SAM will be interrupted by the natural topography of the landscape and several intervening buildings. The A1014 (The Manorway) Road also interrupts the view between the SAM and construction site. This Road experiences approximately 1400 traffic movements per day (Department of Transport Statistics, 2008). Views will be further impeded by the Coryton Oil Refinery site which is located immediately to the west of the proposed GEC site. In addition, the current state of the SAM means that it is unlikely to attract large numbers of visitors, but has been protected for its preservation rather than it's historical setting. Notwithstanding, it is now difficult to appreciate the SAM site in its historic context since the demolition of the Majority of the Thames Haven Oil Refinery.

16.7.9 No further impacts are anticipated on either of the other two SAM listed previously in this Section, due to their significant distance from the site.

16.7.10 As with the SAMs discussed in the paragraph above, the Listed Buildings noted in Table 16.4 of this Section are unlikely to be impacted by the construction phase of the development. This is mainly due to: their distance from the GEC site; intervening developments between the Listed Buildings and the GEC site; and, the relatively minor importance of the Listed Buildings (e.g. residential properties listed for their protection and preservation rather than to protect their overall setting). Therefore, this means that any impacts would be negligible.

16.7.11 In addition, any potential impacts would only apply to Listed Buildings which have a direct line of sight to the construction site. These impacts would also be temporary and short term.

Operation

16.7.12 Once GEC is operational, the main potential impacts are likely to be to the disruption of the cultural setting and appreciation of upstanding cultural heritage, particularly SAMs.

Decommissioning

16.7.13 During the decommissioning stage, there are not anticipated to be any additional impacts other than those mentioned for construction.

16.8 Mitigation

Construction

16.8.1 Prior to construction, a programme of archaeological works will be developed in conjunction with the Essex County Archaeologist, which will form part of the planning conditions for the development of GEC. However, given the industrial nature of the site, in terms of impacts that previous foundations and contamination are likely to have had, as well as the large amounts of archaeological work done on the site in the past, further works are unlikely to be necessary.

16.8.2 In the event that artefacts are encountered, construction work would be halted pending agreement with County Archaeologist on the most appropriate way to proceed.

16.8.3 If, on review by the County Archaeologist, some previously undeveloped areas of the site are considered to have the potential for underground remains, it may be possible to steer foundation construction away from these areas and preserve remains in situ – as is recommended by PPG 16.

16.8.4 Prior to construction, a range of best practice guidance will be established between the construction contractor and the relevant Local Authorities in accordance with the construction contractor.

Operation

16.8.5 During the operational phase of GEC, no adverse impacts to buried archaeology are anticipated. As such, no mitigation is required. Additionally, only negligible impacts have been identified on upstanding remains of archaeological and cultural heritage significance. In addition, confirmed mitigation measures will be applied during the operational phase. These mitigation measures include screening with appropriate landscaping.

Decommissioning

16.8.6 No additional mitigation measures are considered necessary during the decommissioning phase.

16.9 Assessment of Residual Impacts

16.9.1 Providing the mitigation measures listed above are applied correctly, there are not anticipated to be any remaining residual impacts on the archaeology and cultural heritage surrounding the proposed GEC development.

16.10 Assessment of Cumulative Impacts

16.10.1 The potential impacts of the proposed GEC have been assessed alongside the construction of the LG Development and associated access roads. It has also been assessed against the construction of a gas, grid and CHP connections which would serve the GEC site.

16.10.2 As the proposed LG Development is far larger than the GEC and will surround GEC on three sides, the LG Development has far wider reaching implication on the archaeological and cultural heritage resource of the area. However, the LG Development is the subject of a separate Outline Planning Application for which a separate ES has been submitted and approved by the Relevant Authorities. This ES details mitigation measures which will be applied to all potential impacts on archaeology and cultural heritage.

16.10.3 As such, when mitigation measures are taken into consideration for both the development of GEC and the LG Development, there are not anticipated to be any significant impacts on the archaeological or cultural heritage resource of the area.

16.10.4 Impacts associated with any infrastructure associated with GEC (i.e. gas, grid and CHP) will primarily be site specific and therefore no cumulative impacts will occur. The exception to this would be any over ground works associated with the gas off take and grid substation and any associated over ground transmission lines which would have the potential to give rise to cumulative visual impacts. The nature of these impacts will require full assessment as part of any EIA for these projects, however from the studies undertaken thus far the potential for significant cumulative impacts is considered to be low.

SECTION 17

SOCIO-ECONOMICS

17 SOCIO-ECONOMICS

17.1 Summary

17.1.1 During construction of GEC, the workforce is expected to peak at approximately 600 personnel. During operation of GEC, the workforce would be of the order of 15 to 25 personnel if operated in conjunction with CECL Power Station, or up to 40 personnel if operated on a stand-alone basis. There will also be additional indirect jobs for contracted engineering staff during maintenance shutdowns. Experience at the existing CECL Power Station suggests there could be of the order of 10 to 15 additional indirect jobs at the site.

17.1.2 The development of a CCGT Power Plant, such as the proposed GEC, would have a significant capital cost, and a proportion of this, typically anywhere up to 30 per cent, is likely to be spent locally during the construction phase. Furthermore, GEC would also represent an additional annual income source to the local economy during the operational phase.

17.1.3 As such, it is considered that the development of GEC would have an overall positive socio-economic impact on the surrounding area, providing additional jobs and investment whilst also helping the wider UK economy through the development of a highly cost effective means of electricity generation.

17.2 Introduction

17.2.1 This Section assesses the socio-economic impacts of GEC. Details of the assessment methodology and significance criteria are provided, together with the baseline conditions upon which the study and conclusions are based.

17.2.2 In particular this assessment comprises:

- An economic impact assessment, including employment impact on the labour market and additional local spending;
- Land Use and Open Space; and
- Leisure and Recreation / Tourism.

17.2.3 In addition, proposed mitigation and management methods are detailed, where appropriate.

17.2.4 Cumulative impacts of GEC and other developments in the vicinity are also considered.

17.3 Key Planning Policies

17.3.1 Section 3 provides the planning policy content. The policies listed below have informed the assessment process, to which reference has been made in Section 3. A full transcript of these policies is contained in Volume 2 Appendix A.

East of England Plan

SS1	Achieving Sustainable Development
SS9	The Coast
E1	Job Growth
E2	Provision of Land for Employment
E3	Strategic Employment Sites
E4	Clusters
ENV7	Quality in the Built Environment
ETG1	Strategy for the Sub-Region
ETG2	Thurrock Key Centre for Development and Change
ETG5	Employment – Generating Development

17.4 Assessment Methodology and Significance Criteria

Assessment Methodology

17.4.1 The following assessment aims to establish the potential economic and social contributions of GEC, and assess the potential impacts against the current baseline conditions.

17.4.2 Therefore, it is necessary to fully determine the current baseline conditions of the affected areas of the socio-economy. Accordingly, a Desk Study was undertaken to establish the existing situation for the region in line with the defined significance criteria. This included using a range of available data sources, including NOMIS – Official Market Labour Statistics[13].

17.4.3 The likely impacts of the GEC proposal were then considered within the context of these conditions and the appropriate local authority objectives for social and economic development.

17.4.4 The assessment focused on the District of Thurrock as a whole. Comparisons were also made with the present positions of Essex, the East of England, and the rest of Great Britain.

Significance Criteria

17.4.5 The assessment of potential socio-economic impacts of GEC uses the following scale of significance.

17.4.6 The impacts on the socio-economy are defined as being either:

- Adverse — Detrimental or negative impacts to the socio-economy;
- Negligible — Imperceptible impacts to the socio-economy; and
- Beneficial — Advantageous or positive impact to the socio-economy.

17.4.7 Where adverse or beneficial impacts have been identified, these generally have been assessed against the following scale:

- Minor — Slight, very short or highly localised impact of no significant consequence;
- Moderate — Limited impact (by extent, duration or magnitude) which may be considered significant; and
- Major — Considerable impact (by extent, duration or magnitude) of more than local significance or in breach of recognised acceptability, legislation, policy or standards.

17.4.8 Furthermore, temporary or short-term impacts are considered to be those associated with the construction phase. Medium to long-term impacts are considered to be those associated with the operational phase.

17.5 Baseline Conditions and Receptors

17.5.1 This sub-section establishes the current baseline with regards to the following characteristics relevant to GEC:

- Population;
- Skills and Education;
- Labour Force and Employment;
- Occupational Profile;

[13] https://www.nomisweb.co.uk/default.asp

- Land Use and Open Space; and
- Leisure and Recreation / Tourism.

17.5.2 Potential impacts arising from GEC are assessed relative to the current baseline.

Population

17.5.3 The local population of the District of Thurrock has stands at approximately 151 600 (based on 2008 estimates). The populations of the East and Great Britain stand at approximately 5 728 700, and 59 608 200 respectively (also based on 2008 estimates).

17.5.4 Over the ten year period 1998 to 2008, the populations of the District of Thurrock, the East and Great Britain increased by 9.3 per cent, 8.1 per cent and 4.9 per cent respectively.

Skills and Education

17.5.5 Approximately 32.8 per cent of people in the District of Thurrock qualified to at least National Vocational Qualification (NVQ) Level 3. This is lower than both the East and Great Britain.

17.5.6 In addition, the percentage of people within Thurrock with no qualifications is higher than that for both the East and Great Britain.

17.5.7 This information is shown in Table 17.1.

TABLE 17.1: COMPARISONS OF QUALIFICATIONS

Qualifications	***Thurrock***		***East***	***Great Britain***
	Number	***%***	***%***	***%***
NVQ4 and above	16 000	16.8	26.1	29.0
NVQ3 and above	31 300	32.8	43.4	47.0
NVQ2 and above	49 900	52.3	62.8	65.2
NVQ1 and above	69 800	73.2	78.8	78.9
Other Qualifications	6 700	7.0	9.3	8.7
No Qualifications	18 900	19.8	11.8	12.4

Labour Force and Employment

17.5.8 In 2008, the working age population (16 to 59/64 year olds) of Thurrock was approximately 95 000. Of this, 80 400 (80.4 per cent) were economically active. This is slightly lower than the rates in the East which were 81.7 per cent, but higher than those of Great Britain which were 78.9 per cent.

17.5.9 Of the economically active population, which is defined as people who are either in employment or unemployed, the number of people who were in employment was 74 600 (including 75.2 per cent of the working age population). This is also slightly lower than the rates in the East which were 77.3 per cent, but higher than those of Great Britain which were 73.9 per cent.

17.5.10 Employment in Thurrock has varied over the last few years with employment rates fluctuating more so than both the averages for the East and Great Britain. However, local employment has been lower than the averages for the East, but higher than the average for Great Britain. This is shown in Table 17.2.

TABLE 17.2: EMPLOYMENT RATES (% 16-59/64 YEAR OLDS)

Year	*Thurrock*		*East*	*Great Britain*
	Number	*%*	*%*	*%*
2004	74 800	78.5	78.6	74.4
2005	73 600	76.8	78.1	74.5
2006	72 900	75.1	77.1	74.3
2007	75 100	76.7	77.4	74.4
2008	74 600	75.2	77.2	74.2

17.5.11 Recently, the global economic recession has resulted in a sharp and significant increase in unemployment numbers and those seeking Job Seekers Allowance (JSA).

17.5.12 Over the last year, unemployment has risen significantly in Thurrock, the East and Great Britain. In August 2008 the levels of people claiming JSA in Thurrock were reported at 2 205, which represented 2.3 per cent of the workforce. This rose to 4 230, representing 4.5 per cent of the workforce, in August 2009. Over the same period, people claiming JSA in the East and Great Britain also rose from 1.9 per cent to 3.5 per cent and 2.4 per cent to 4.2 per cent respectively. This demonstrates that the economic recession is having an impact on all areas.

Occupational Profile

17.5.13 Based on information from Thurrock Council[14], the occupational profile in Thurrock is very similar to the profiles of the East and England albeit with slight variances.

17.5.14 The largest proportion of the population are employed in distribution, hotels and restaurants (22.1 per cent) followed by public administration, education and health (20.9 per cent) and banking, finance and insurance (15.6%).

TABLE 17.3: EMPLOYEES BY OCCUPATION

Occupation	*Thurrock*	*East*	*England*
	%	*%*	*%*
Agriculture and Fishing	0.3	1.5	1.1
Energy and Water	1.0	0.7	0.8
Manufacturing	13.9	13.7	14.0
Construction	10.5	8.7	7.6
Distribution, Hotels and Restaurants	22.1	19.3	19.6
Transport and Communications	10.9	7.1	7.0
Banking, Finance and Insurance	15.6	17.3	16.2
Public Administration, Education and Health	20.9	25.6	27.5
Other Services	4.8	6.1	6.2

17.5.15 The mean gross weekly income by workplace in Thurrock is £473.30, which is similar to the mean gross weekly income by workplace of both the East and Great Britain which are £468.10 and £479.10 respectively.

Land Use and Open Space

17.5.16 The GEC site is located within an area designated on the Thurrock Borough Local Plan as Employment Land, and is specifically designated as Oil Refineries. Out with the GEC site, this designation covers most of the LG Development site.

17.5.17 Out with the LG Development site, the land is designated for Landscape and Nature Conservation.

[14] http://www.thurrock.gov.uk/i-know/profile/content.php?page=dd_labour

Leisure and Recreation / Tourism

17.5.18 Whilst the GEC site lies on land within the LG Development on land that is designated in the Thurrock Borough Local Plan as Employment Land, out with the LG Development the land is designated for Landscape and Nature Conservation and contain a number of Statutory Ecological Designated sites.

17.5.19 The Statutory Ecological Designated sites include:

- Thames Estuary and Marshes SPA and RAMSAR site;
- Benfleet and Southend Marshes SPA and RAMSAR site;
- South Thames Estuary and Marshes SSSI;
- Benfleet and Southend Marshes SSSI;
- Vange and Fobbing SSSI;
- Mucking Flats and Marshes SSSI;
- Holehaven Creek SSSI;
- Pitsea Marsh SSSI;
- Basildon Meadows SSSI;
- Northward Hill SSSI;
- Chattenden Woods SSSI;
- Dalham Farm SSSI;
- Thundersley Great Common SSSI;
- Canvey Wick SSSI;
- Leigh NNR;
- High Halstow Northward Hill NNR;
- Linford LNR;
- Grove House Wood LNR;
- Vange Hill LNR;
- Canvey Lake LNR; and
- Belton Hills LNR.

17.5.20 Non-Statutory Ecological Designated sites include:

- Wat Tyler Country Park;
- Northlands Wood Country Park; and
- Corringham Marshes SINC.

17.5.21 Impacts specifically to these sites have been described in Section 13. This Section considers the impacts to the users of these sites for leisure and recreational purposes.

17.5.22 Further to this, Table 17.3 suggests that approximately 22.1 per cent of the population of the District of Thurrock are employed in the distribution, hotels and restaurants business (which can be directly related to the tourism industry). This is higher than the percentages of the East and England which are 19.3 per cent and 19.6 per cent respectively. This would suggest that is healthy tourism related industry in the District of Thurrock.

17.6 Potential Impacts

Socio-Economic Benefits of Electricity Generation

17.6.1 There is a certain link between economic activity and electricity consumption.

17.6.2 The generation of electricity from GEC will add to the capacity and flexibility of the UK Electricity Generation System, which is an important contributing factor supporting economic activity, and will be required to supplement the national requirement for electricity.

17.6.3 As such, based on the discussion provided in Section 2, GEC will make a contribution to national electricity demand. However, this contribution cannot be quantified at this stage.

Construction

Employment Impact on the Labour Market and Additional Local Spending

17.6.4 The civil works that will constitute the initial stages of the construction will require a small unskilled workforce. The subsequent mechanical and electrical works will utilise a larger workforce with more specialised skills.

17.6.5 During the peak of construction of GEC, the workforce is expected to total approximately 600 personnel. Based on estimates taken from the construction of the nearby CECL Power Station, it is hoped that up to 25 per cent of this workforce could be recruited from local residents.

17.6.6 Additionally, the construction period (estimated to be up to 36 months in duration) could provide a tangible amount of work for local contractors. Based on the information provided in Table 17.3, the manufacturing and construction industries form a significant part of the local employment landscape at approximately 24.4 per cent.

17.6.7 Works machinery will be required for all aspects of the development of GEC and may be, in part, sourced from local plant hire companies.

17.6.8 As such, based on the above information it is likely that, in the short-term, employment will increase during the construction phase. The labour force required to construct GEC will consist of a combination of a skilled and semi-skilled workforce. Whilst the majority of the skilled workforce is likely to be drawn from outside the local area, (as was the case for CECL and the development of the CECL Power Station) GECL will seek to draw a percentage of the workforce from local contractors and companies.

17.6.9 Therefore, in terms of the employment impact on the labour market and additional local spending, the construction of GEC is expected to have a minor beneficial short-term impact on the local economy.

Land Use and Open Space

17.6.10 GEC will be constructed and operated on land within the LG Development.

17.6.11 Based on the existing land use types, it is anticipated that the construction of GEC will have a minor beneficial short-term impact on the Land Use.

17.6.12 During construction, land situated in the north of the GEC site will be used for construction laydown. This land will be returned to its original condition once GEC is operational and will be reserved for future CCR purposes.

Leisure and Recreation / Tourism

17.6.13 The workforce recruited from outside the area is likely to commute weekly to the GEC site. The temporary accommodation requirements will be provided by local hotels and guesthouses, or privately, generating more business in this sector of the local economy and increasing spending in the area.

17.6.14 Construction workforces typically comprise a high proportion of single males who make relatively low demands on education, health and recreational facilities. In the event that large numbers of the construction workforce is recruited from outside the area, it is anticipated that no significant impact will be made on such services.

17.6.15 Therefore, the construction of GEC is expected to have a minor beneficial short-term impact on tourism related income, i.e. money spent on local hotels and guesthouses.

Operation

<u>Employment Impact on the Labour Market and Additional Local Spending</u>

17.6.16 GEC will be designed with a view to a high degree of automatic operation. However, operator intervention will be necessary from time to time.

17.6.17 The operational workforce would be of the order of 15 to 25 personnel if operated in conjunction with the existing CECL Power Station, or up to 40 personnel if GEC is operated on a stand alone basis. There will also be additional indirect jobs for contracted engineering staff during maintenance shutdowns. Experience at the existing CECL Power Station suggests there could be of the order of 10 to 15 additional indirect jobs at the site.

17.6.18 Skilled operators will make up approximately 95 per cent of the operational workforce. The skilled operators will have a background appropriate to their discipline and will receive additional training relating to power plant operation. The knowledge of the manufacturer will be transferred to the operating staff during the commissioning phase of GEC by ensuring full and active participation in the trials and testing of the plant equipment.

17.6.19 Staff at all levels will receive training on process and emission control and will be able to benefit from the experience of the operators of the existing CECL Power Station. Regular appraisals will be made of all training requirements. GEC will be operated in accordance with the manufacturer instructions.

17.6.20 It is anticipated that around half of the operational staff will work on a five-shift system, with four on duty at any one time. The remaining staff will work during normal office hours.

17.6.21 GEC will occasionally be shut down for periods of essential maintenance and statutory inspections. Minor outages (of the order of 4 days) are expected to occur every year. Major outages (of the order of 4 weeks) are expected to occur every three years. Major plant maintenance shut downs will be planned on a long-term basis with intermediate stoppages being infrequent and of short duration only.

17.6.22 During minor outage periods (expected for every year) there may be up to 30 jobs which could be created for contracted engineering staff. During major outage periods (expected every three years) up to 400 personnel may visit the site for a period of about four weeks.

17.6.23 Estimates of average local spend[15] from the existing CECL Power Station indicate an average annual local spend of £1.59 million (averaged over 5 years). This is further estimated to be approximately 17 per cent of the total spend. During an outage year, it would be expected that up to a further £950 000 would be locally spent. In addition, if local labour was not used during outages, the travelling labour impacts would be expected to positively benefit the local economy with an increased amount of spending on local hotels, etc.

[15] *Local expenditure is taken to be any supplier with a postcode within one hour drive of the CECL Power Station site.*

17.6.24 Based on this information, the operation of GEC is expected to have a minor beneficial long-term impact on the local economy.

Land Use and Open Space

17.6.25 GEC will be constructed and operated on land within the LG Development.

17.6.26 Based on the existing land use types, it is anticipated that the operation of GEC will have a minor beneficial short-term impact on the Land Use.

17.6.27 Further to this, the land used for construction laydown will be returned to its original condition once GEC is operational and will be reserved for future CCR purposes. Therefore it is likely that the operation of GEC will have a negligible long-term impact.

Leisure and Recreation / Tourism

17.6.28 Section 11 presented the Landscape and Visual Impact Assessment for GEC. In this Section, photomontages were prepared which indicated that that some parts of GEC would be visible from the surrounding area.

17.6.29 However, the GEC site was previously part of the Shell Oil Refinery site which was decommissioned in 1999. Furthermore, GEC will be viewed within the context of the existing CECL Power Station (700 m east) and Coryton Oil Refinery (950 m east) and the future LG Development. As such there is a long industrial history in the vicinity of the GEC site.

17.6.30 Therefore, it is considered that GEC will sit within the context of the past, existing and future landscape of the area and, thus, will not cause any negative impact on the view of the area. In addition, there will be no unacceptable risk to public safety in the vicinity of GEC or any adverse effect on existing, or allocated, land uses in the area.

17.6.31 In addition, if local labour was not used during outage periods, the travelling labour impacts would be expected to positively benefit the local economy with an increased amount of spending on local hotels, etc.

17.6.32 As such, it is concluded that there will be negligible impacts to leisure and recreation / tourism from the development of GEC.

17.7 Mitigation

Construction

17.7.1 The construction of GEC will provide jobs for the region and, directly and indirectly, bring increased expenditure into the local economy.

17.7.2 No mitigation measures or monitoring programmes are considered to be necessary due to the high positive socio-economic impact of GEC during construction.

Operation

17.7.3 The operation of GEC will create permanent employment opportunities and, wherever possible, establish strong local service links which would last for the operating lifetime of GEC. There are no negative impacts expected on any other aspect of the local economy.

17.7.4 No mitigation measures or monitoring programmes are considered to be necessary due to the high positive socio-economic impact of GEC during operation.

17.8 Assessment of Cumulative Impacts

17.8.1 In terms of the cumulative impacts associated with the construction of the LG Development, the gas and HV electricity connection and any CHP connection for the GEC there are likely to be short-term / temporary employment opportunities similar to those described above for GEC.

17.8.2 These short-term / temporary employment opportunities are likely to present a minor beneficial short-term impact on the local economy.

17.8.3 During operation of the Gas Pipeline and Electricity Transmissions line there is likely to be minimal employment opportunities created. As such, these are likely to have negligible socio-economic impacts.

17.8.4 In terms of the CHP infrastructure, as discussed in the CHP Assessment GEC has the potential to provide heat and / or power to facilities and / or customers in the surrounding areas. This has further potential to attract certain developments to the area, therefore presenting a possible minor beneficial long-term impact to the area.

17.8.5 In terms of the LG Development, GEC may provide up to 150 MWe in addition to the potential heat and / or power discussed above. This has further potential to attract certain developments to the area, in particular for business to occupy plots within the LG Business and Logistics Park to present further minor beneficial long-term impacts to the area.

SECTION 18

SUMMARY OF MITIGATION AND MONITORING

18 SUMMARY OF MITIGATION AND MONITORING

18.1 Summary

18.1.1 The mitigation and monitoring programmes proposed for GEC are summarised below.

18.2 Air Quality

Construction

18.2.1 Good site management practices during the construction works will help to prevent the generation of airborne dust. GECL will require its construction contractors to take sufficient precautionary measures to limit dust generation.

18.2.2 To ensure that atmospheric dust, contaminants or dust deposits generated by the construction do not exceed levels which could constitute a health hazard or nuisance to those persons working on the GEC site or living nearby, a dust monitoring programme will be carried out throughout the construction period as part of the CEMP. Details of this are provided in Section 5. If the potential for dust emissions exists, for example on dry windy days, then the following procedures or similar will be followed where appropriate:

- Materials will be assessed for moisture content;
- If material is dry then water will be sprayed on to the working area to suppress dust;
- Excavation faces not being worked will, if required, be either sheeted or treated with a suitable dust suppressant; and
- All operatives working in areas of potential dust emission will be provided with paper type face masks.

18.2.3 In addition, the following measures or similar will be implemented where appropriate:

- Materials deposited on stockpiles on the GEC site will be closely monitored for any possible emission of dust and if required they will be damped down, covered or treated with a dust suppressant;
- If finely ground materials are delivered, it may be required that these are in bag form or stockpiled in specified locations where the material can be suitably covered;
- All vehicles carrying bulk materials into or out of the GEC site should be covered to prevent dust emission, and minimum drop heights will be used during material transfer;
- Potential dust emissions from moving construction plant and site transport will be mitigated by the use of water bowsers, which will dampen all movement areas being utilized by traffic;
- Wheel washing facility will be provided, if necessary, adjacent to the GEC site exit which will be used by all heavy commercial vehicles leaving the GEC site, preventing the transmission of soil from the GEC site to the public highway; and,
- Also a road sweeping vehicle will be employed when required during the construction period to remove dust and dirt from all the public roads.

18.2.4 It should be noted that the above measures may only be necessary should the activities leading to the greatest dust generation occur during a dry period. As such, if care is taken during construction, dust emissions will not impact on local air quality.

Operation

18.2.5 The following mitigating measures have been included in the design of GEC:

- The use of DLN Combustion Technology, which ensures NO_x levels will be in accordance with LCPD requirements;

- The use of a fuel inherently low in sulphur; and
- A stack of sufficient height and flue gases of sufficient temperature and velocity to ensure good dispersion.

18.2.6 In combination, the above measures will result in limited increases in background concentrations of NO_x, negligible emissions of particulates and negligible emissions of SO_2, such that no further measures are deemed necessary.

18.2.7 Emissions will be controlled during operation in accordance with the manufacturer's recommendations and the limits and conditions specified in the Environmental Permit for the process, taking account of the technical guidance available for this type of plant.

18.2.8 The stacks will be fitted with a continuous NO_x and CO monitor. The measured value will be recorded and displayed in the Control Room. Routine calibration checks will be carried out as recommended by the manufacturer and as agreed with the EA. Any other ad-hoc calibration checks required by the EA will be carried out. An oxygen monitor will also be supplied and results from this will be used to correct the NO_x measured value to the format required by the EA. Either a moisture meter will be provided or a mathematical correction factor based on combustion of natural gas will be used to convert to the dry condition. The results from this stack monitoring will be available to the public in the Public Register held by the EA.

18.2.9 Sampling points and safe access adjacent to the continuous monitoring points will be installed.

18.2.10 Regular observation of stack air emissions will also be made.

18.3 Noise and Vibration

Construction

18.3.1 In order to keep noise impacts from the construction phase to a minimum, all construction activities would be carried out in accordance with the recommendations of BS 5228. In addition, the following mitigation measures would be implemented through the Construction Environmental Management Plan (CEMP):

- Initially and until the buildings are closed and capable of providing an 'indoor working environment', construction work will only take place during Monday to Saturdays 07:00 – 19:00 hours. No work on any Sunday or Bank Holidays will be undertaken, unless such work is associated with an emergency or does not cause existing ambient noise levels to be exceeded at nearby Noise Sensitive Receptors (NSR). Should a need arise, due to technical constraints or similar, with regard to carrying out certain construction work outside the time indicated above, prior written approval from Thurrock Borough Council (TBC) (as the relevant Health Authority) will be sought.
- To the extent required by the local authority, specific method statements and risk assessments would be produced for night working. In order to minimise the likelihood of noise complaints in such eventualities, the contractor would inform and agree the works in advance with the Environmental Health Officer (EHO), informing affected residents of the works to be carried out outside normal hours. Furthermore, the residents would be provided with a point of contact for any queries or complaints.
- All vehicles and mechanical plant used for construction will be fitted with customary exhaust silencers, and regularly maintained.
- Plant construction equipment will be used where appropriate. All major compressors will be sound-reduced models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers.

- All ancillary plant construction equipment such as generators, compressors and pumps will be positioned so as to cause minimum noise disturbance. If necessary, temporary acoustic barriers or enclosures would be provided.

Operation

18.3.2 Planning noise limits will be agreed with the Local Authority at the consent stage, and GECL will take all measures required to assure compliance with these planning noise limits.

18.3.3 The following measures would serve to continually monitor and minimise the impact of noise from the GEC:

- A computer model of the proposed plant items will be produced at the detailed design stage, to calculate the predicted noise levels at the NSR locations, and ensure that planning limits are adhered to. Detailed design will ensure that site noise is mitigated as far as possible, through site layout and orientation of noisy plant items.
- Since tonal or impulsive noises are considered more annoying than continuous noise sources, plant items will be silenced or otherwise controlled through regular maintenance to ensure no such emissions are audible at NSR locations.
- A noise survey shortly following the commissioning of the new plant, shall be agreed with the Local Authority. The aim of this survey shall be to ensure that plant noise levels as measured at the agreed NSR locations do not exceed the planning noise limits agreed with the local authority. Noise monitoring shall be undertaken in accordance with BS 4142.
- In the event of a complaint by a local resident relating to noise levels during the operation of the Development, an investigation shall be carried out by the operator, or a representative thereof, to determine the likely cause of the complaint, and if necessary any available remedial measures. Where it is deemed necessary by the Local Authority, a written report detailing these measures and their effectiveness will be provided.
- In addition to the noise control measures mentioned above, silencers will be fitted to achieve noise attenuation on plant including gas turbine and HRSG inlets and ductwork. Acoustic lagging and low noise trims will be fitted to specific pipe-work and noise generating steam valves where required.
- Acoustic enclosures will be considered, and provided where required, for all plant items where practicable, including for smaller plant items such as compressors and pumps.
- Where required, internal surfaces within the turbine hall should be treated to control internal reverberant noise levels. An appropriate treatment would consist of dense mineral wool panel behind perforated sheet steel, or a spray on cellulose fibre treatment.
- In the interest of maintaining neighbourly relations and residential amenity, the company will give a reasonable period of notice to residents and the local authority prior to any planned non-normal operations that would lead to an increase in noise levels. These planned events will be carried out between 0900 and 1700 hours during the weekdays, wherever possible.
- Although 'normally-off' plant items have not been included in the modelling of normal plant operation, these will be afforded the same level of noise control as all other plant as appropriate.

18.4 Landscape and Visual

Construction

18.4.1 A Construction Management Plan would be prepared in support of the proposed site development.

18.4.2 The Construction Management Plan would attempt to minimise any potential landscape and visual impacts during construction by addressing the following:

- Careful placement of the temporary storage of topsoil and any other material considered of value for retention;
- Provision of wheel washing facilities and soil dampening will ensure that debris and soils do not escape to the surrounding environment; and
- Careful design and layout of site construction areas including the location and type of temporary security fencing and lighting.

Operation

18.4.3 Overall, the main element of mitigation incorporated into the scheme to prevent, reduce or offset any adverse effects has been the careful siting of the proposed plant and associated infrastructure. In doing so the need for extensive works on pipelines and transmission lines has been minimised.

18.4.4 With regard to the layout of the site, a conscious effort was made in the feasibility stages of the project design to endeavour to align the plant buildings with those of the surroundings.

18.4.5 The GEC Development will, in the future, likely benefit from a scheme of planting implemented as part of the surrounding LG Development that will help to minimise the impact of lower lying plant items such as the water tanks, administration building, stores and other such buildings.

18.4.6 Other mitigations measures proposed include the following typical conditions associated with the development of a power station in the UK:

- The final architectural design of the plant will be sensitive to the suggestions of local planning officers and LG;
- The final architectural design of the buildings will be carefully considered to provide a high standard of visual amenity, given practical and economic constraints; and
- The external structures will be designed such that there will be minimal deterioration in the appearance of GEC over its lifetime.

18.4.7 A limited combination of materials will be used in the construction of the external structures at GEC to give it a cohesive appearance. At upper levels, colour coated profiled sheeting will likely be used. At lower levels, including low level buildings, facing brickwork or dense concrete masonry will be used, where appropriate. A recessive colour scheme will be used in order to break up the impact of the built structures. The final colour scheme will be agreed with TTGDC and LG.

18.4.8 GEC will include the following lighting systems: site lighting; emergency lighting; road lighting; and, area floodlighting. Lighting systems will be designed to be similar to those used on the LG Development. Lighting systems will comply with current best practice and industry standards in order to minimise light spread and glare off site.

18.5 Ecology

18.5.1 Mitigation and management measures, implemented as part of the LG Development, have already been outlined in Section 12.4. The relationship between the LG Business and Logistics Park Ecological Management and Mitigation Plan (EMMP) and any EMMP prepared for GEC should be established to ensure that any requirements within the GEC site set by the LG Business and Logistics Park EMMP can be delivered. Establishing the relationship between the GEC EMMP and the LG Business and Logistics Park EMMP will also ensure opportunities for co-ordination between the two EMMPs are identified and exploited.

18.5.2 The following suggested mitigation measures are put forward to reduce the predicted impacts that are due to the construction and operation of GEC alone.

Construction

Designated Sites

Statutory Designated Sites

18.5.3 As there will be no significant impacts on Statutory Ecological Designated Sites, no mitigation measures are proposed.

18.5.4 Therefore, the impacts will remain as negligible magnitude and not significant.

Non-Statutory Designated Sites

18.5.5 The distance from the construction site and implementation of the EMMP will ensure that no significant adverse effects from pollution events will occur at Non-Statutory Ecological Designated Sites

18.5.6 Therefore, the impacts will be of negligible magnitude and not significant.

Habitats and Species

18.5.7 As there will be no significant impacts on any habitats or species no mitigation measures are proposed.

18.5.8 Therefore, the impacts will remain of negligible magnitude and not significant.

Operation

Designated Sites

Statutory Designated Sites

18.5.9 Although measures to minimise atmospheric pollution are included within the design of GEC, it has been predicted that there will be a significant adverse impact during the operational phase on Thundersley Great Common SSSIs. It is important to recognise however that this prediction assumes a worst case operational scenario of the plant operating at 100 per cent load for the 93 per cent of the year that the plant is available. In practice the plant is unlikely to operate for this proportion of the year and the impact is considered to be an over prediction of the true impact that will be encountered during the operation of the GEC. As such no mitigation is proposed for this impact though GEC propose an on going dialogue with regard to impacts to this receptor with the relevant authorities.

Non-Statutory Designated Sites

18.5.10 No significant adverse impacts are anticipated during the operational phase on non-statutory designated sites. As such, no specific mitigations measures are provided.

18.5.11 The height of the stacks will ensure that levels of deposition will dissipate. Mitigation provided for other VERs (such as landscaping) will help to further reduce the effects of the predicted slight increase in air pollution, noise and disturbance on the two non-statutory sites.

All Habitats and Species

18.5.12 As there will be no significant impacts on any habitats or species no mitigation measures are proposed.

18.5.13 The implementation of the Operational Environmental Management Plan (OEMP) will further ensure accidental spillages and unnecessary disturbance are avoided.

18.5.14 Therefore, the impacts will remain as negligible magnitude and not significant.

18.5.15 In addition, there is considerable opportunity to provide biodiversity enhancement as part of the landscaping works for the GEC site. PPS9 and the Natural Environment and Communities Act (1981) both place responsibilities on developers, Statutory Bodies and Local Authorities to deliver ecological enhancements within new development. Mitigation and enhancement work has already been provided as part of the wider LG Development and therefore any landscaping and mitigation provided within the GEC site would be considered a direct enhancement in comparison with the baseline against which the impacts of GEC have been assessed.

18.5.16 The following recommendations should be considered in the detailed design of landscaping for the site.

- Additional ponds could be provided on site. These could be designed in particular for amphibians and aquatic invertebrates but would also provide value for a variety of bird species. It is understood that a large number of ponds will be provided as part of mitigation and enhancement for the wider LG Business and Logistics Park development. Therefore any ponds provided would compliment this mitigation.
- Grassland surrounding the GEC could be planted with a locally appropriate species-rich grass seed mix. In particular, areas could be designed to incorporate a number of the nationally notable species recorded within the wider LG Business and Logistics Park area, such as divided sedge, broad-leaved spurge and dittander. Any such enhancement would need to carefully consider the soil and hydrology of the developed site and be designed appropriately. The incorporation of the above species, for example, would not be appropriate in areas where the drainage has been significantly improved. The creation of grassland areas would also be of benefit to terrestrial invertebrate species and would also provide habitat for reptiles and amphibians should any re-colonisation of the area take place from adjacent habitats.
- Landscape planting, in particular any screen planting would provide new habitat for nesting birds and terrestrial invertebrate species as well as providing new features of value to foraging and commuting bats. Bird nesting boxes could also be provided on buildings within the area to immediately increase the availability of nesting habitat on site.
- The OEMP produced could also include prescriptions relevant to the management of habitats within the site to maximise their value to wildlife. This could include low frequency, ecologically sensitive grass cutting to allow grass and flora species to flower and set seed. The OEMP should also include recommendations for the management of drainage features and any ponds provided on site. Consideration should be given to the potential for habitats to be re-colonised by species such as water voles, reptiles and great crested newt, and advice provided accordingly to ensure that offences under the Habitats Regulations (1994) and the Wildlife and Countryside Act (1981) are not committed in the process of undertaking routine management. This may require an element of ecological monitoring across the site during the operational phase.

18.5.17 Any or all of the above measures would enhance the value of the GEC site for biodiversity. The operational noise, vibration and disturbance resulting from the GEC site may depress the potential value of the surrounding habitats for wildlife.

18.5.18 However, many wildlife species are known to habituate to relatively high levels of baseline disturbance, and as such wildlife would be anticipated to re-colonise suitable habitats within the site over time.

18.5.19 Formal assessment of these measures has not been made as they have not yet been agreed.

18.6 Water Quality

Construction

18.6.1 The British Standard Code of Practice for Earthworks BS 6031:1981 contains detailed methods that should be considered for the general control of drainage on construction sites. Further advice is also available in the British Standard Code of Practice for Foundations BS 8004: 1986. These will be taken into account in the design and construction of GEC.

18.6.2 Mitigation measures during construction will include, as appropriate:

- Any oil storage tanks to be located on an impervious base provided with bund walls to give a containment capacity of at least 110 per cent of the tank volume. All valves and couplings to be contained within the bunded area.
- Any surface water contaminated by hydrocarbons, which are used during the construction phase, to be passed through oil / grit interceptor(s) prior to discharge.
- Measures will be taken to ensure that no leachate or any surface water that has the potential to be contaminated is allowed to enter directly or indirectly into any water course, underground strata or adjoining land. These will include concrete gullies, dewatering ponds and other similar measures.
- Provisions to be made so that all existing drainage systems continue to operate. These will include visual inspections and corrective measures as appropriate.
- Water inflows to excavated areas to be minimised by the use of lining materials, good housekeeping techniques and by the control of drainage and construction materials in order to prevent the contamination of ground water. Site personnel to be made aware of the potential impact on ground and surface water associated with certain aspects of the construction works to further reduce the incidence of accidental impacts.
- Refuelling of construction vehicles and equipment to be restricted to a designated area with properly designed fuel tanks and bunds and proper operating procedures.

Operation

18.6.3 The EA will set limits on the quality of water that is discharged from the GEC site under the Environmental Permit. The GEC will include an on-site Sewage Treatment Plant that will treat domestic effluents prior to discharge to the wider drainage system.

18.6.4 All aqueous process effluents will be discharged to the wider drainage system of the and will be in accordance with limits set by the EA in the Environmental Permit.

18.6.5 No further on-site treatment will be necessary. This represents the best practicable environmental option for these effluents and is consistent with the approach suggested in Chapter 2 of the EA's PPC Combustion Sector Guidance Note V2.03.

18.6.6 The Water Treatment Plant effluent will be monitored for pH value. If the pH is out with the limit of 6 to 9, or outside any limit permitted by the EA, the discharge will stop until the failure is corrected.

18.6.7 The use of anti-icing substances will be minimised during the winter.

18.6.8 All oil and chemical storage tanks and areas where drums are stored will be surrounded by an impermeable bund. Single tanks will be within bunds sized to contain 110 per cent of capacity and multiple tanks or drums will be within bunds sized to contain 110 per cent of the capacity of the largest tank. Permanently fixed taps, filler pipes, pumping equipment, vents and piping will be located through the wall of the bund with normally locked valves. After inspection of the water accumulated in the bunds the valves will be unlocked and opened allowing the accumulated water to flow from the bund.

18.6.9 Taps and valves will be designed to discharge downwards and will be shut and locked in that position. Manually started electrically operated pumps will remove surface water collected within the bund and its composition will be verified through appropriate analysis prior to disposal.

18.6.10 The surface water drainage system will drain areas of the GEC site unlikely to be contaminated with oil due to their location and discharge the water to the storm water drainage system. The majority of the surface water drainage will be uncontaminated and typical of surface water run off from paved areas or roads. The potential for contamination is minimal and associated with areas around storage vessels which will be appropriately bunded.

18.6.11 An oily waste water drainage system will drain all areas where oil spillages could occur. The design will incorporate oil interceptors and traps. These will discharge with the other surface water discharge to the storm water discharge system. The discharge from each oil interceptor will contain no visible oil or grease.

18.6.12 Adequate facilities for the inspection and maintenance of oil interceptors will be provided and the interceptors will be emptied as necessary and desludged to ensure efficient operation. A qualified contractor will dispose of the sludge off-site.

18.6.13 All elements of the treatment systems will be regularly monitored to ensure optimum performance and maintenance.

18.6.14 GEC will be designed to take into account the flood risks associated with the site which is discussed in detail in the FRA included in Volume 2, Appendix D and summarised in this Section of the ES.

18.7 Geology Hydrology and Land Contamination

Construction

Construction Workers / Current Site Users / Off Site Properties

18.7.1 Gas monitoring and accurate characterisation of the gassing regime at the site will be undertaken prior to construction. Gas monitoring standpipes will be placed around the site. Suitable PPE including the recommended grade of respiratory equipment can then be made available in order to minimise any potential impacts.

18.7.2 Dust suppression measures will be put in place to minimise dust levels on the site and in the surrounding environment. These measures are detailed in Section 9, Air Quality and include dowsing or covering of stockpiles during dry and windy weather.

18.7.3 Any additional soil materials that are to be imported to the sites will be required to have certification of their chemical concentrations to ensure that contaminative materials are not being introduced to the area.

18.7.4 The construction site will be fenced and site controlled access will be limited to construction workers and official vehicles. The site will be manned with security 24 hours a day during construction. This will prevent any members of the public from coming into contact with potentially contaminated materials.

Geology and Soils

18.7.5 In order to further limit disturbance, the site access tracks will be constructed first to allow movement of vehicles around the site on areas of soft-standing. Any vegetation, topsoil and subsoil will be removed to expose a suitable sub-grade. Any soils, sub-soils or aggregate suitable for reuse will be stockpiled on impermeable liners. Soils which are to be reused onsite will be tested geotechnically and for contamination. This will form part of a site waste management plan (SWMP) which will be drafted prior to construction and will focus on the re-use, recycling and reduction of waste spoil.

18.7.6 Speed restrictions will be imposed on site to minimise disturbance of bare surfaces and the amount of disturbed surfaces left exposed for significant time periods will be minimised. Stockpiles of loose, fine materials will be damped down or covered over if necessary, again to reduce erosion and the production of dust. The control of airborne dust is discussed in Section 9 of this ES - Air Quality.

Water Use, Disposal and Hydrology

18.7.7 The access roads will be constructed to manage drainage of surface water and a temporary wheel washing facility will be installed to prevent transfer of soil onto nearby public roads.

18.7.8 If any existing surface water drains on site interfere with the CCGT location, they will be re-routed prior to development of the site. This will move them directly away from the influence of construction activities.

18.7.9 Surface water, perched waters or groundwater from dewatering operations will not be discharged to surface water, foul or surface water drains without the appropriate consents from the local water or Sewage Company and / or the EA. The disposal of this effluent will be the responsibility of the contractor. If necessary this water will be tanked off-site for disposal at a suitable facility.

18.7.10 Temporary drainage routes and silt fences, constructed of geotextile, will be constructed if deemed necessary. Any pumping will be undertaken at such a rate using an appropriately sized pump in order to avoid disturbance or erosion of the stream banks. The location of dewatering pipework will be carefully positioned. The contractor will regularly inspect all dewatering pumps, pipe work and connections.

Operation

18.7.11 All foundations will be appropriately specified to resist chemical attack from soils or groundwater.

18.7.12 Foundations will also be designed so as not to present a preferential pathway for contaminant migration, if present at the site.

Decommissioning

18.7.13 A decommissioning plan will be prepared in compliance with best practice 12 months prior to decommissioning.

18.7.14 At this stage it is anticipated that the decommissioning area will be delineated and measures taken to avoid vehicle use outside the working boundary. In order to further limit disturbance, the site access tracks will be taken out last.

18.7.15 Any soils, sub-soils or aggregate suitable for reuse will be stockpiled on impermeable liners.

18.7.16 Dust suppression measures will be put in place to minimise dust levels on the site and in the surrounding environment. These measures are detailed in Section 9 of this ES – Air Quality.

18.7.17 Any additional soil materials that are to be imported to the site will be required to have certification of their chemical concentrations to ensure that contaminative materials are not being introduced to the area.

18.7.18 Speed restrictions will be imposed on site to minimise disturbance of bare surfaces and the amount of disturbed surfaces left exposed for significant time periods will also be kept to a minimum.

18.7.19 The site will be re-instated (as far as is reasonably possible) to its former use. Clean topsoil and turf will be imported where necessary and the site will be re-graded.

18.8 Traffic and Infrastructure

Construction

18.8.1 Access to the proposed site will be through the London Gateway Logistics Park. The existing roads on the LG landholding will connect the GEC site entrance, on the west boundary of the GEC site, to the A1014 Manorway (Gate 3 of the Logistics Park) and, via the A13, to the M25 motorway.

Transport Management Plan

18.8.2 All vehicle movements associated with the construction of the GEC will operate under a Transport Management Plan (TMP). The purpose of the TMP will be to provide a framework for the active management of all potential issues resulting from the increased demand on the local transport infrastructure to ensure that all impacts are minimised or eliminated.

Key Features

18.8.3 The preparation of a detailed TMP is not practical at present as the project has not yet entered the detailed design stage therefore the exact requirements of the construction have not yet been established. However, the key features of the TMP will be:

Transport Manager
GECL will appoint a Transport Manager to co-ordinate all aspects of transport associated with the construction of the GEC and be responsible for the effective implementation of the TMP.

Definition
Targets and objectives will be set with regard to issues including traffic volumes and the scheduling of deliveries to the site and appropriate procedures and control methods will be established in full consultation with the Highways Agency and Thurrock Council.

Monitoring
GECL will monitor the level of on-site personnel, volumes and timings of vehicles travelling to and from site and the adherence to timetables throughout the construction phase of the project.

Review
The monitoring results will be regularly assessed to evaluate the effectiveness of all strategies defined within the TMP and to anticipate any variance from the targets or key dates within the construction programme.

As part of the review process the Transport Manager will discuss all relevant issues with other users of the London Gateway to establish the scope for the provision of shared traffic management services. These discussions will also help to identify any potentially significant cumulative impacts on the local transport infrastructure and define appropriate mitigating measures that could be mutually beneficial.

Reporting
Regular updates will be provided to the Highways Agency and Thurrock Council as to the performance of the TMP and any issues identified as a result of the review and monitoring.

Update of TMP

The TMP is intended to operate as a working document that will evolve throughout the construction phase. The Transport Manager will ensure that all proposed modifications to the Plan will be discussed and agreed with the Highways Agency and Thurrock Council, in advance and as necessary.

18.8.4 Upon completion of the detailed civil engineering design it will be possible to provide a more accurate assessment of the traffic requirements and local impact of the proposed construction. The TMP will incorporate a Green Travel Plan to encourage the use of sustainable transport methods however this will only be defined once final recruitment/contractor details are known.

18.8.5 All details of the Traffic Management Plan will be fully agreed with the Highways Agency and Thurrock Council within an appropriate timescale and prior to the commencement of any on-site construction work.

Abnormal Loads

18.8.6 Construction contractors will be required to survey all routes to ensure that any abnormal load can be transported to site by road with the least inconvenience to other road users. The contractors will be responsible for the cost of any route strengthening requirements.

18.8.7 The transportation of abnormal loads can lead to disruption and delays. Routes and timings of the transportation of abnormal loads will be discussed with the relevant authorities in order to minimise disruption. A police escort may also be used.

Operation

18.8.8 Traffic associated with the operation of the GEC will have an insignificant effect on the wider road network and thus will require no further mitigation.

18.9 Cultural Heritage

Construction

18.9.1 Prior to construction, a programme of archaeological works will be developed in conjunction with the Essex County Archaeologist, which will form part of the planning conditions for the development of GEC. However, given the industrial nature of the site, in terms of impacts that previous foundations and contamination are likely to have had, as well as the large amounts of archaeological work done on the site in the past, further works are unlikely to be necessary.

18.9.2 In the event that artefacts are encountered, construction work would be halted pending agreement with County Archaeologist on the most appropriate way to proceed.

18.9.3 If, on review by the County Archaeologist, some previously undeveloped areas of the site are considered to have the potential for underground remains, it may be possible to steer foundation construction away from these areas and preserve remains in situ – as is recommended by PPG 16.

18.9.4 Prior to construction, a range of best practice guidance will be established between the construction contractor and the relevant Local Authorities in accordance with the construction contractor.

Operation

18.9.5 During the operational phase of GEC, no adverse impacts to buried archaeology are anticipated. As such, no mitigation is required. Additionally, only negligible impacts have been identified on upstanding remains of archaeological and cultural heritage significance. In addition, confirmed mitigation measures will be applied during the operational phase. These mitigation measures include screening with appropriate landscaping.

Decommissioning

18.9.6 No additional mitigation measures are considered necessary during the decommissioning phase.

18.10 Socio-Economics

Construction

18.10.1 The construction of GEC will provide jobs for the region and, directly and indirectly, bring increased expenditure into the local economy.

18.10.2 No mitigation measures or monitoring programmes are considered to be necessary due to the high positive socio-economic impact of GEC during construction.

Operation

18.10.3 The operation of GEC will create permanent employment opportunities and, wherever possible, establish strong local service links which would last for the operating lifetime of GEC. There are no negative impacts expected on any other aspect of the local economy.

No mitigation measures or monitoring programmes are considered to be necessary due to the high positive socio-economic impact of GEC during operation.