Thurrock Flexible Generation Plant

Environmental Statement Volume 2
Chapter 3: Alternatives

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Environmental Impact Assessment

Environmental Statement

Volume 2

Chapter 3

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Summary

It is a requirement of any EIA that the developer must outline the reasonable alternatives considered and the reasons for selecting the preferred option taking into account the effects of the on the environment. This chapter explains how the grid connection point was chosen and how a site within the vicinity of the connection point was selected. It goes on to explain how the masterplan has evolved to respond to environmental risks and opportunities to achieve an optimum layout.

Qualifications

This document has been prepared by Mark Barrett BSc (Hons), MSc, an Associate with 16 years' experience in environmental impact assessment.

It has been checked by Tom Dearing, a Chartered Environmentalist and full Member of the Institute of Environmental Management and Assessment, who has ten years' experience of environmental impact assessment.

1. Introduction

1.1 Approach

1.1.1 Thurrock Power has been through a logical, staged decision-making process to arrive at the proposed development location and design. In this chapter, the project environmental decision-making around alternatives is summarised in two stages follows.

Stage 1 Setting out a 'project requirements/imperatives statement' leading to an appraisal against agreed criteria for:

a) connection point selection; and
b) Site selection and justification.

Stage 2 Comparison of environmental and technical issues at the chosen site relating to:

a) site arrangement/massing options;
b) design/appearance options;
c) phasing and future-proofing options; and
d) access/construction method options.

1.1.2 The remainder of this chapter explains in more detail the site selection and environmental decision-making processes used, the information collected, and the reasons given for the proposed project.

1.2 Scope

1.2.1 This chapter does not go into detail about the relative technical benefits of different gas-to-electricity generation technologies given that this will be dealt with in the justification of 'Best Available Technology' (BAT) required by the Environment Agency (EA) in order for an Environmental Permit to be granted for the facility's operation. A draft BAT justification has been written in consultation with the EA and was submitted with the EIA Scoping Report.

2. Stage 1 – Grid Connection Options

2.1 Project Requirements / Imperatives

2.1.1 The national and regional need for flexible generation projects of this type is set out in detail in the Statement of Case (application document A8.3) as part of the Development Consent Order (DCO) application.

2.1.2 The flexible generation plant concept proposed by Thurrock Power needs to satisfy a number of project imperatives, as follows.

a) Electrical engineering criteria – to manage / meet the demand for electrical power at peak periods in a sustainable way by providing:
   i. at least 600 MW of gas-fired electricity generation;
   ii. at least 150 MW of battery storage;
   iii. fast response generation in 5-7 minutes for gas (less for batteries); and
   iv. potential to capture and store carbon.

b) Economic criteria – to export sufficient power to the grid at a commercially attractive rate to justify the investment by delivering a development that can:
   i. export at least 1,800 GWhrs of electricity per annum, excluding battery storage;
   ii. have timely implementation (be available without substantial delays for, e.g., gas or grid connection capacity);
   iii. minimise electricity transmission losses and gas connection costs; and
   iv. have hours of operation towards 3,000-4,000 hours per year.

c) Regulatory criteria – complying with all regulatory constraints / targets such as:
   i. Grid code compliance, Generating Licence, Balancing and Settlement Code, Connection and Use of System Charges;
   ii. Part A Environmental Permit, allowing mid-merit hours of operation;
   iii. DCO requirements; and
   iv. Greenhouse Gas Emissions Permit (or equivalent following Brexit transition period).

2.2 Connection point selection

2.2.1 Any generating station must connect to the electricity grid at a suitable location. The suitability is determined by the generation scale and the available capacity to accept the new power both at the substation and along the transmission/distribution network.

2.2.2 A high-level grid connection options study was completed in conjunction with National Grid Electricity Transmission (National Grid) and regional Distribution Network Operators (DNOs) that identified a number of regional networks where demand was highest and capacity was available. A regional study was conducted on the area operated by DNO UK Power Networks and a refinement of that study focused on the area to the east of Greater London.

2.2.3 Proximity to both gas and electricity grids is the principal driver for this project's location. Therefore, the gas supply requirements were overlain on the possible electricity grid connection options, i.e. around existing main Grid Supply Point (GSP) or Bulk Supply Point (BSP) substations.

2.2.4 Connection options were tested against the following criteria:

- grid capacity (both substation and network);
- proximity to the high-pressure national transmission system (NTS) for gas;
- proximity to electricity demand (as determined by the network operator); and
- land availability and cost.

Table 2.1: Connection point criteria.

Subject	Criteria
Grid capacity	At least 750 MW
Available connection date	2021-22
Proximity to NTS	Max 3 km
Feasible NTS route incl. Consultation Zone	Land use
Minimum annual export from gas engines	1,800 GWhrs

Grid connection options shortlist

2.2.5 Figure 2.1 shows the 275 kV network and the gas NTS in the study area, the green belt, and the network of substations.

2.2.6 Based on grid-related factors, cost analysis and other considerations, the study narrowed down the choice to existing substations on the 275 kV network around Greater London that met the above criteria. These substations are:

- Tilbury;
- Elstree; and
- Warley.

2.2.7 All three sites are in the green belt, albeit Tilbury is on the very periphery of it.

2.2.8 Further discussions with National Grid revealed that Elstree was not likely to be suitable from an engineering feasibility perspective. Elstree is also further from the national transmission system for gas than the other two substations.

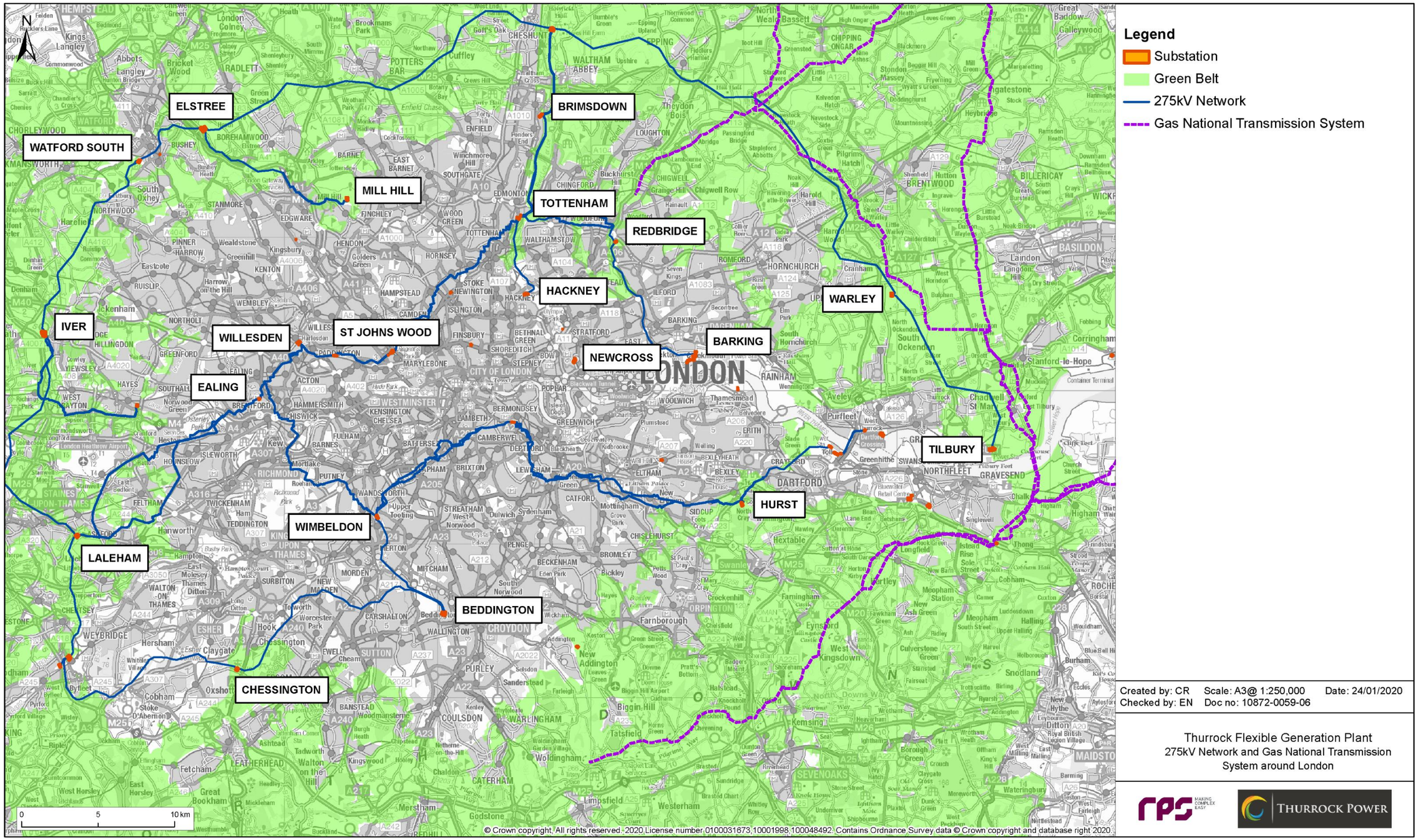

Figure 2.1: Map of the London 275 kV network, substations, gas NTS and Green Belt.

Grid connection options analysis

2.2.9 Tilbury and Warley were progressed to a final selection stage and were tested against the following environmental and technical criteria at a high level to identify potentially available development areas in the vicinity of each substation. The criteria were:

- access;
- environmental designations;
- residential receptors;
- land use and policy; and
- other development proposals.

2.2.10 A study area of 1 km around the substations was defined as the initial basis for a search of developable areas.

2.2.11 Figure 2.2 shows the constraints around Warley Substation. Warley Substation has a number of residential properties in close proximity to the substation. Little space is available adjacent (to the north) due to the buffer around property and ancient woodland.

2.2.12 Figure 2.3 shows the constraints around Tilbury Substation. Tilbury Substation is further from residential property in comparison to Warley. An undeveloped corridor from the NTS to the substation is available. (Note that the flood zone as mapped is the undefended scenario when in fact the substation site benefits from flood protection at a standard of 1:1,000 years.)

2.2.13 Both Warley and Tilbury development site options are within the Green Belt designation, albeit Tilbury is on the very periphery.

Matters relating to Green Belt policy

2.2.14 The National Planning Policy Framework (2019) confirms that the government attaches great importance to Green Belts, and that the fundamental aim of Green Belt policy is to prevent urban sprawl by keeping land permanently open: the essential characteristics of Green Belts are their openness and their permanence.

2.2.15 National Policy Statement (NPS) EN-1 reiterates the importance placed on Green Belts by the government and refers back to Green Belt policy in Planning Policy Guidance Note 2 and its successors. Paragraph 5.10.17 of NPS EN-1 confirms that the determining authority will "*attach substantial weight*" to harm to the Green Belt.

2.2.16 Paragraph 134 of the NPPF describes five purposes of the Green Belt:

a. to check the unrestricted sprawl of large built-up areas;

b. to prevent neighbouring towns merging into one another;

c. to assist in safeguarding the countryside from encroachment;

d. to preserve the setting and special character of historic towns; and

e. to assist in urban regeneration, by encouraging the recycling of derelict and other urban land.

2.2.17 The applicant has set out in the Statement of Case (application document A8.3) how the proposed development responds to each of the five purposes of the Green Belt, and where there is potential for conflict with any of these purposes. The applicant has also considered the potential for 'other harm' as a result of the proposed development, which has been informed by the consultation and environmental assessment process. Where conflict with the purposes of the Green Belt occurs, the applicant has presented the 'very special circumstances' that exist which would be used to offset the harm that would otherwise be caused by inappropriate development, along with other harm as may be identified.

2.2.18 The consideration of alternatives has also been a key part of the Green Belt case. The applicant's approach to site identification and the consideration of alternatives is set out in this chapter of the ES, and the applicant has sought feedback from the Preliminary Environmental Information Report (PEIR) consultation on the site selection and alternatives process that has been followed.

2.2.19 In accordance with paragraph 5.10.12 of NPS EN-1, the applicant has sought to demonstrate in the Statement of Case that the installation of connecting electricity and gas infrastructure to facilitate the project will constitute engineering operations and will not, therefore, be considered to be inappropriate development in the circumstances of the application.

2.2.20 The applicant has consulted with Thurrock Council on matters relating to Green Belt policy, and how the proposed development is likely to be considered, in Green Belt policy terms, once the DCO application is submitted.

Option selection

2.2.21 Warley was found to be more heavily constrained by proximity to sensitive receptors and in a more sensitive landscape setting but was closer to the gas network. Possible development sites at Warley were limited in size and availability.

2.2.22 Tilbury did not exhibit such constraints. Feasible site opportunities were identified on the periphery of the existing substation and Tilbury is an acceptable distance c. 2 km from the gas transmission network. Tilbury was selected as the preferred connection point and was tested in more detail to confirm deliverability.

2.3 Site selection

2.3.1 Identification of potential development sites in the vicinity of Tilbury Substation considered the following deliverability issues in addition to the planning and environmental constraints.

- Typical site arrangement / plot size – the approx. minimum site area was set at 15-20 ha.
- Site acquisition issues – the landowners were canvassed for their willingness to sign a lease, with a preference to avoid compulsory purchase.
- Engineering issues – high level land preparation and access considerations were examined.

Preferred site selection

2.3.2 Land to the south and west of Tilbury Substation is constrained by existing land uses and development including Tilbury2 and future development possibilities for the former Tilbury B Power Station site (notwithstanding the withdrawal of the Tilbury Energy Centre proposal from the DCO application process). There are other considerations such as the proposed Lower Thames Crossing nearby to the east and ongoing Ingrebourne Valley land-raising operation. A proposed strategic release of Green Belt land at Tilbury could also increase the pressure of development on the surrounding area.

2.3.3 A single land holding was identified that satisfied the search criteria and was capable of providing all development land and access that wasn't affected by the above development proposals.

2.3.4 The site is immediately north of the existing National Grid substation and although heavily constrained by three high-voltage overhead power line routes (making it unattractive to other types of development), can be used for this project.

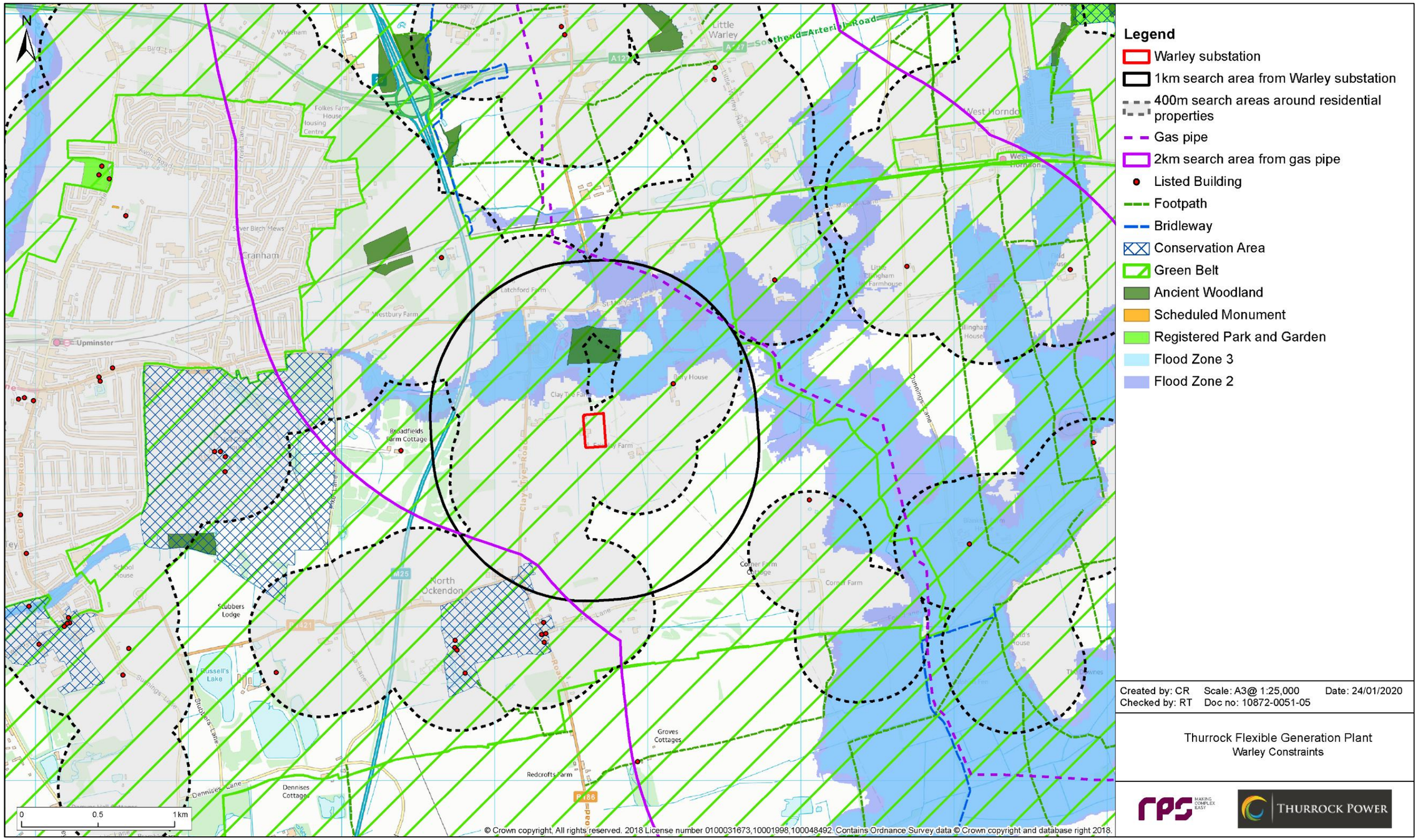

Figure 2.2: Constraints around Warley Substation.

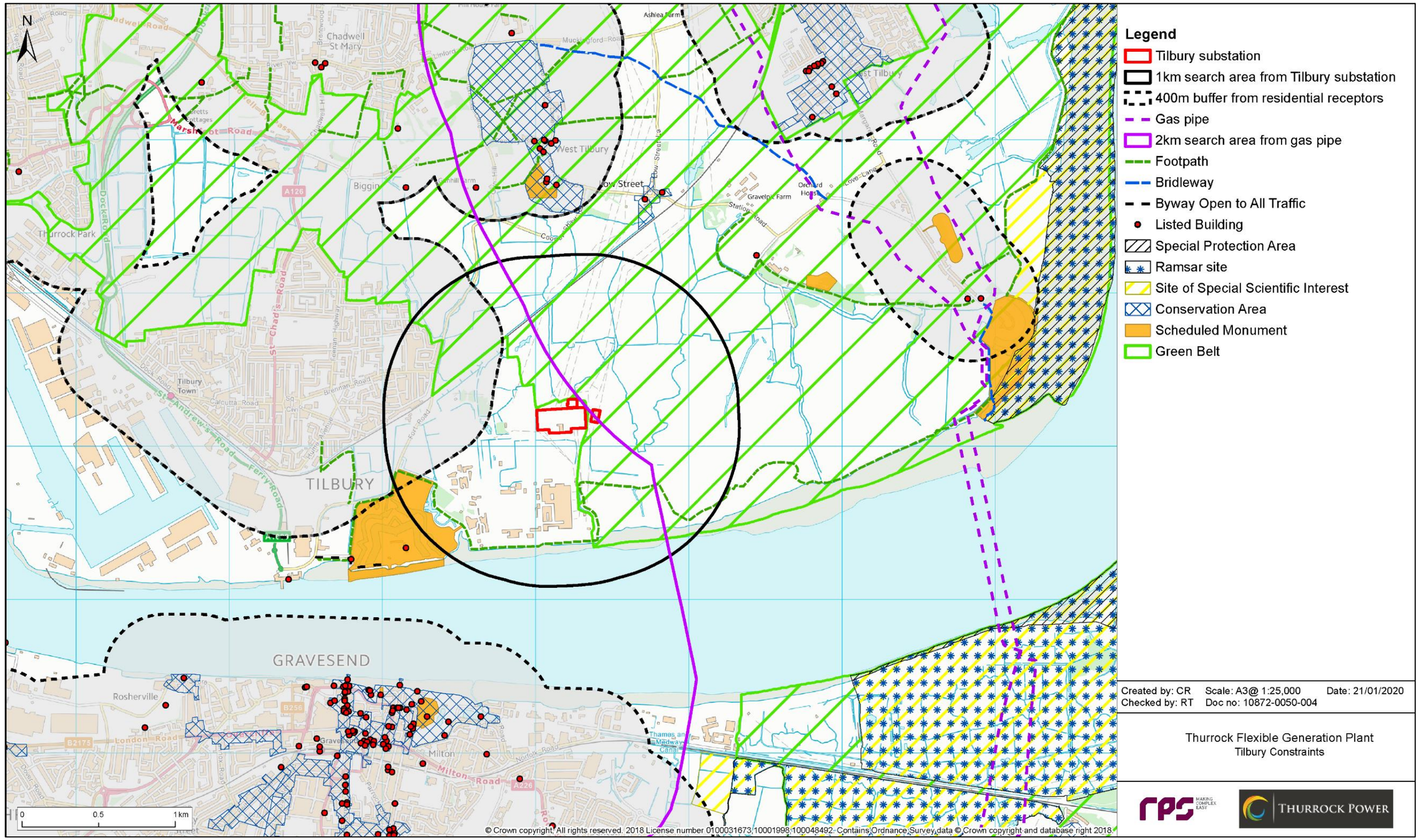

Figure 2.3: Constraints around Tilbury Substation.

3. Stage 2 – Site Development Alternatives

3.1 Introduction

3.1.1 An iterative master planning process was used to evaluate alternative arrangements of the site. The development site was analysed for constraints and key priorities were identified. The factors influencing the placing of equipment within the site are as follows:

- physical constraints, principally the pylons and overhead lines;
- landscape character and visual sensitivity;
- access (both temporary and permanent);
- proximity to noise sensitive receptors;
- flooding and drainage; and
- area for carbon capture readiness.

3.1.2 The overall aim of the masterplan is to improve the utility of the site and to respond sustainably to the environmental risks and opportunities.

3.2 Site master-planning

3.2.1 Evolution of the masterplan started out with plotting the principal constraints to development on the site, which are:

- no gas engines or batteries directly under the overhead lines (OHLs);
- 1.5 times stack height fall-over distance to the OHL (1.5 x 40 m);
- project substations nearest to the point of connection (south); and
- flexibility to build out in phases.

3.2.2 The masterplan has been led by the imperatives of:

- land use efficiency;
- environmental and sustainability risks and opportunities; and
- engineering and cost optimisation.

Land use efficiency

3.2.3 The improvements in land use efficiency are a balance of the operational and safety requirements of maintaining separation between equipment allied with allowing space within the site for drainage features and future carbon capture equipment. Sufficient contingency has been achieved that future-proofs the site for possible carbon capture and storage technologies within the same boundary.

Environmental and sustainability risks and opportunities

3.2.4 Iterative feedback during the EIA has informed the arrangement of the site in response to the following issues.

Access

3.2.5 Permanent site access would be developed from an existing junction with Station Road, running to the south and parallel with the railway. Access to the site during operation is minimal as the site will not be permanently manned.

3.2.6 Temporary access is required for large indivisible loads that exceed the geometry of local roads to the permanent site entrance at Station Road, and for the balance of construction traffic.

3.2.7 Multiple options were studied and consulted upon. Road access options considered included access from the north via Brentwood Road from the A13 to the junction of High House Lane, crossing Linford Road onto Turnpike Lane, Gun Hill and Coopers Shaw Road; or from the west via a temporary haul road from the B129 St. Chads Road at Gateway Academy connecting with Gun Hill and Coopers Shaw Road. A haul road in Parsonage Common and craning indivisible loads across the railway line was studied.

3.2.8 The first option using existing minor roads would require upgrading in places and one way working due to restrictions in the width of some road sections. A purpose-built temporary haul route from the west would be less a disruptive option for local traffic. In both cases craning large loads across the railway would have caused impacts to Parsonage Common.

3.2.9 Access by river was considered at an early stage but initially rejected due the existing jetty and intervening land being in use for land-raising, land further east being part of the plans for the Lower Thames Crossing and land further west being part of the proposed Tilbury Energy Centre.

3.2.10 Subsequently, however, the Tilbury Energy Centre proposal has been withdrawn, making delivery by river to a haul road crossing that land possible. Alongside this, the Tilbury2 development with an upgraded access road to that development from the A1089 strategic highway has been consented. Together these factors have led to the primary access routes proposed being from the south, via the A1089 and by barge on the river for large indivisible loads. This minimises impacts on the local and strategic highway network.

Visual effects

3.2.11 The main visual impact of the proposed development is from the 40 m exhaust stacks. Due to the land forms of the area, principal views north-south (i.e. towards and from the Thames) and so an approximately north-south alignment of gas engines minimises the visual impact of the stacks, as they are seen in line. The site is immediately north of the existing Tilbury substation and there are three overhead line routes within the site. These existing vertical elements serve to reduce the possible impact of the proposed development on the landscape setting.

Flooding and drainage

3.2.12 The site is in flood Zone 3a and as such would be at a high risk of flooding (tidal) were there no defences. As it is, the site is defended to a 1:1,000 year (tidal) return period (inclusive of climate change) resulting in a protected flood zone category equivalent to Zone 1. Design of the site has responded to the residual threat of a theoretical breach in the flood defences through appropriate resilience measures, as set out in the Conceptual Drainage Strategy (application document A7.3) and the Flood Risk Assessment (ES Volume 6, Appendix 15.1). The flood risk posed is tidal and the development, with designed-in runoff attenuation, will not increase the risk of flooding elsewhere.

3.2.13 Initial site layout design extended to the boundaries of Zone A, the main development site, but the boundary ditches are environmentally sensitive. To the greatest extent possible, the site layout has therefore been designed to retain existing boundary ditches and allow a suitable stand-off distance in construction such that the hydrological environment and Water Voles present would not be disturbed.

Noise

3.2.14 There are two main areas where the design has responded to environmental noise risks. First is site selection and site orientation; second is noise mitigation technology and design.

3.2.15 Tilbury was selected as a site that demonstrated less risk of environmental noise effects due to distance from properties, with the nearest being more than 600 m away. Insofar as possible within the site constraints, the noisiest pieces of equipment (i.e. gas engines) are sited towards the south of the site, away from the nearest residences beyond the railway line to the north.

3.2.16 As set out in Volume 3, Chapter 11: Noise and Vibration, noise mitigation measures for the development design are specified to control noise levels and avoid significant adverse impacts for residents.

Construction methods

3.2.17 The majority of equipment on site will be modular, manufactured and largely assembled off-site, with limited work required for assembly and to make connections in situ. Off-site manufacturing and assembly has a number of advantages for this type of project, in reducing the on-site construction programme (and duration of impacts) and reducing transport requirements for materials, construction waste and workforce.

Gas pipeline

3.2.18 A variety of routes and crossing points of watercourses, hedges and roads for the gas pipeline have been considered within an initially-defined broad route corridor. The route selected for the application minimises agricultural land-take and retains flexibility where appropriate to micro-site crossing locations to minimise loss of hedgerow or trees that are ecologically sensitive.

3.2.19 Trenched and trenchless construction techniques have been considered, and the latter will be used for watercourse crossings to avoid ecological and hydrological impacts at those locations.

Engineering and cost optimisation

3.2.20 Cooling by water was rejected at an early stage due to predicted operating costs and the distance of the site from open water. A ‘once-through’ cooling of the gas engines with water would be at least double the cost of cooling with fin fan radiators (as proposed). This is primarily because of the distance between the river and the engine plant (2.8 km) and the hydraulic head required.

3.1 Conclusions

3.1.1 A staged selection process has been employed to identify a grid connection point and a development site. National and regional grid operators have been consulted to ensure that the project delivers the optimum public benefits.

3.1.2 The first stage looked at technical, electrical and cost considerations and identified three connection point options on the 275 kV network east of London.

3.1.3 An appraisal of site availability and deliverability resulted in Tilbury being selected as the preferred connection option.

3.1.4 Land near to Tilbury substation was studied leading to the proposed site being selected.

3.1.5 The second stage sought to optimise the development site's capacity to respond to its environmental risks and opportunities and to choose optimal construction access and gas connection routes.

3.1.6 Iterative design feedback during the EIA process and consultation on the PEIR has prioritised the most significant environmental issues, resulting in a balanced proposal that optimises environmental and sustainability issues with commercial and deliverability imperatives.

4. References

Ministry of Housing, Communities and Local Government (2019) National Planning Policy Framework (NPPF). London, Department for Communities and Local Government.

Department of Energy and Climate Change (DECC) (2011a). Overarching National Policy Statement for Energy (EN-1). London, The Stationery Office.