

A consideration of alternative sites to those nominated as part of the Government's Strategic Siting Assessment process for new nuclear power stations

Prepared by Atkins for the
Department of Energy and Climate Change

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Preface

This Study has been prepared by Atkins, for the Department of Energy and Climate Change, to consider alternative sites to those nominated as part of the Government's Strategic Siting Assessment (SSA) process for new nuclear power stations.

We have used information from energy companies, historic site studies carried out by the Central Electricity Generating Board (CEGB) and others and our own national screening exercise. The study identified sites in England and Wales, in addition to the 11 nominated sites, to assess whether in our opinion, these sites would meet the SSA criteria.

We refer to these sites as "*worthy of further consideration*" in recognition that it is for Government (on the basis of advice from Regulators and others), to determine whether they are suitable or potentially suitable from the perspective of the SSA.

Sites that we identified in this Study as *worthy of further consideration* are:

- Druridge Bay, Northumberland
- Kingsnorth, Kent
- Owston Ferry, Lincolnshire

Beyond these three alternative sites we believe that it would be reasonable to conclude that, on the basis of current information and technology, there are no other areas or sites *worthy of further consideration*, for the purposes of the Nuclear National Policy Statement (NPS).

We are indebted to the following for their input and support in undertaking this Study:

- Michael Gammon, who was Head of Generation Development Branch at CEGB from 1977 to 1989 and was a witness at the Sizewell B and Hinkley Point C Inquiries on siting issues. Mr Gammon's specific recollections of sites considered by CEGB are included as part of Chapter 3, but he has contributed to and reviewed the report as a whole.
- Bob Tivey, who was a Senior Planning and Consents Manager at the CEGB between 1978 and 1989 and worked on both the Sizewell B and Hinkley Point C planning applications and Public Inquiries.
- The Health and Safety Laboratory (HSL), who undertook a peer review of the Study, and reached the conclusion that it considers the methodology developed by Atkins to be robust and consistent with best practice for an exercise of this kind.

We are also appreciative of comments on our methodology from the Health and Safety Executive's Nuclear Directorate, the Environment Agency, the Office for Civil Nuclear Security, the MOD and the Civil Aviation Authority which have helped us ensure that our approach has been as consistent as possible with the SSA process and the assessment of nominated sites.

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Executive Summary

The Strategic Siting Assessment (SSA) process and the National Policy Statement for Nuclear Power Generation

The Government has run a Strategic Siting Assessment (SSA) process to identify and assess sites which are suitable for the deployment of new nuclear power stations by the end of 2025. This process was set out in detail, in January 2009, in the Government's response to the 2008 SSA consultation exercise. The results of the SSA will inform the development of the proposed National Policy Statement (NPS) for new nuclear power (the 'Nuclear NPS'). Under the planning regime set out in the Planning Act 2008, an NPS is a statement of national policy that the independent Infrastructure Planning Commission (IPC) will use as the framework for its decision on an individual application for development consent.

In the consultation response, the Government made clear that it recognised the potential significance of early deployment of new nuclear power stations in achieving the UK's objectives on climate change. This means that, although the cut-off date for the SSA is the end of 2025, it saw significant value in early deployment before this date and would have regard to this factor when assessing the suitability of potential sites.

The deadline for nomination of sites for assessment was 31 March 2009. Eleven nominations were received.

The objectives and approach of this Study

The Government has made clear that the SSA is primarily a nomination-driven process. This recognises that industry and other third parties are well placed to identify sites but the SSA will provide an opportunity for the Government to assess suitability of the sites at the national level. It also recognises that suitable sites are likely to have significant commercial value and, accordingly, there may be commercial pressures to identify suitable sites. However, the Government also stated that, to ensure for the various reasons set out in the January 2009 consultation response that alternatives have been sufficiently considered at the strategic level, it would consider whether further steps to consider alternative sites were needed and would reflect the outcome of this when publishing the Nuclear NPS. In particular, the Government said that it would ask nominators how they decided which sites to nominate and would carry out its own study of alternative sites. The purpose of this Study is to support the Department of Energy and Climate Change (DECC) in its consideration of sites for new nuclear power stations that are alternatives to the 11 nominated sites. Consequently, the nominated sites have not been assessed as part of the Study. The Study is not, in any way, a substitute for the SSA process: the assessment of nominated sites is able to draw upon detailed information from nominators and responses to the public engagement window, neither of which is available to us. It also benefits from a much more detailed assessment of the suitability of each nominated site against the SSA Criteria by specialists including other Government departments and regulators than is possible for a national, strategic-level alternatives study.

It is worth recognising that, given enough innovation, effort, time and money, it may be theoretically possible to build, operate and decommission a nuclear power station almost anywhere. This Study is, therefore, not looking to rule out sites as *impossible* from the perspective of siting. In carrying out this Study, Atkins has sought to identify sites that we consider are *worthy of further consideration* – that is where, in our opinion, the area or site would meet the SSA Criteria. Conversely, areas or sites which, in our opinion, there is a reason to suggest that it would not meet the SSA Criteria, are classified as *not worthy of further consideration*. In making these judgements we are drawing on what is reasonable in terms of good engineering practice, safe and reliable operation and impact on the environment and other established activities.

In identifying an area or site as *worthy of further consideration*, we are signalling that we believe it may have merit as a potential site for the development of one or more new nuclear power stations by 2025, but further thought would need to be given by DECC before any decisions about its suitability could be taken. In identifying a site as *not worthy of further consideration*, we are not saying that we believe it should be irrevocably ruled out from future development. In putting forward a detailed proposal, an energy company may be able, at some future stage, to conceive actions or steps that minimise or mitigate the concerns that we have identified.

In coming to our views on sites that are *worthy of further consideration*, we have drawn together three complementary sources of analysis:

- Consideration, through discussions with energy companies and the Nuclear Decommissioning Authority, of the approach they followed to select sites to nominate as part of the SSA process. Where possible, we also discussed with them the sites that they identified as worthy of interest and subsequently declined to nominate, along with the reasons for each such decision.
- Consideration of historic studies and analysis for the siting of nuclear power stations in England and Wales, especially those undertaken by the Central Electricity Generating Board (CEGB) in the 1960s to the 1980s. Recognising that a number of factors including nuclear technology itself, population, amenity and environmental considerations (including understanding of the impact of climate change) have changed very considerably since the time these studies were prepared, we offer a view of the merits of such sites today.
- A screening exercise of the whole of England and Wales (with the exception of the areas around the nominated sites themselves), at an appropriate level of detail and in a way consistent with the SSA Criteria. To do this, we developed a Geographical Information System (GIS) database and suitable datasets that allowed us to apply our technical judgement in a clear and robust way.

This Study was restricted to an analysis of potential sites in England and Wales, in line with the scope of the SSA itself.

Conclusions

We interviewed all the organisations that have nominated sites as part of the SSA process and most of the other energy companies that have contributed to and shown an interest in the sites to be nominated. Our conclusion is that, in coming to their decisions on which sites to nominate, energy companies have behaved as one would expect commercial companies to do in taking business decisions on potential nuclear new build investments. From the perspective of this Study, we note that some companies have taken decisions not to nominate sites on the grounds of distance from existing transmission and distribution infrastructure and have given significant weight to the proximity of existing nuclear sites. They have also been influenced by the need to consult local communities before nominating sites and the importance of securing and maintaining the support of those communities. However, proximity to existing sites, public acceptability and distance from existing transmission and distribution infrastructure are not SSA Criteria, although the Government does ask nominators to outline the potential timing of any transmission and distribution infrastructure required to make the site operational, as part of its consideration of whether a site was deployable by 2025. They are therefore not used as part of this Study. That said, and although

the reasons for our conclusions may differ with those given to us by energy companies, we agree that all of the sites that energy companies considered but decided not to nominate are *not worthy of further consideration* with the exception of Druridge Bay in Northumberland and part of the area west of Sheerness in Kent near the existing Kingsnorth Power Station. Here, energy companies ruled the site out on grounds of transmission access, visual impact, land availability and land use, arguments that have merit but which are not explicit SSA criteria and these are not relevant for this screening process.

Our analysis of the historic studies available to us from the CEEB and others (plus discussions with former CEEB employees) led us to identify 83 sites that had, at some point, been considered as possible locations for new nuclear power stations. In our view, there are reasons to rule out all but three of these as *not worthy of further consideration*. The exceptions are: Druridge Bay in Northumberland (which papers from 1985 show that the CEEB was intending to develop within five years); Kingsnorth in Kent (which, in 1985, the CEEB thought it might consider within 10 years); and Owston Ferry in Lincolnshire (which the CEEB were said to be interested in, along with other 'Humberside' sites).

Our own screening exercise for England and Wales confirmed that Druridge Bay, Kingsnorth and Owston Ferry are the only sites or areas which, in our opinion, would meet the SSA Criteria. In relation to Owston Ferry, it is worth noting that it may be technically feasible to build a nuclear power station on a number of sites on the lower River Trent, but the sequential approach inherent in Planning Policy Statement 25: Development and Flood Risk (PPS25) would guide any development towards lower flood risk areas and Owston Ferry would therefore be preferable.

Overall our conclusions are that the following sites are *worthy of further consideration* for deployment by the end of 2025:

- Druridge Bay, noting that the screening process identified that there is a nationally designated area of ecological importance along the shoreline, the impact to which, we believe, could be mitigated by siting the station a little way back from the coast itself and running the cooling water culverts underneath the shoreline. We note, however, that Druridge Bay is part of the Northumberland Heritage Coast and part of the land is owned by the National Trust. We note there is no Grid connection in close proximity, with the nearest transmission lines in excess of 10 km away.
- Owston Ferry, noting that we strongly believe there are drawbacks inherent in river-based sites that may make them unattractive from the perspective of development. For example, the use of river water for cooling may lead to reduced thermal efficiency that (while we have explicitly excluded economic factors from our Study) could result in lower power generation and thus a significant loss in revenue, and there may be a susceptibility to reduced operations during drought. There is also an absence of any precedent for river-based nuclear power stations in the UK. Furthermore, while significantly less of an issue than upstream on the Trent, siting a new nuclear power station at Owston Ferry would be likely to be problematic to the light aviation (and military aviation) community. It may be that, given these factors, river-based sites are not realistic contenders for development by 2025. Furthermore, we note that all 11 sites nominated as part of the SSA process are coastal locations and, in our discussions with energy companies about river-based sites, some ruled out their development completely and even the most positive regarded them as a low priority (although not totally ruled out in the longer term).

- Kingsnorth, noting that the proximity of areas of high population may present problems in relation to licensing and emergency planning. While these are matters for the regulators to consider in consultation with the local authorities' emergency planners when detailed plans for any development are available, it may be that, given these factors, a site so close to a conurbation the size of Greater London and the Medway Towns is not a realistic contender for development. Certainly, in our view, societal risks associated with the development of a new nuclear power station at Kingsnorth will be significantly higher than for similar stations in less populated areas. In addition, even though there is an existing conventional power station nearby, it may still be challenging to demonstrate that a new nuclear power station at Kingsnorth could operate without there being an adverse impact on the nearby internationally designated sites.

We further conclude that none of these three sites is a contender for early deployment. The basis for this judgement is both the clear lack of interest shown by energy companies in any of these sites for the development of new nuclear power stations and some specific local factors that make development more problematic and time-consuming. These factors include: the complexity of Grid connection and cooling water outfall issues at Druridge Bay, the novel nature of the river-based site (in licensing, logistics and other terms) at Owston Ferry, and issues at Kingsnorth to do with the likely closure and decommissioning of the existing coal station as well as plans (although not yet granted Section 36 consent) for new conventional power stations in the immediate vicinity. Overall, we judge that the impact on deployment (and therefore delay) could be significant.

Beyond these three alternative sites we believe that it would be reasonable to conclude that, on the basis of current information and technology, there are no other areas or sites *worthy of further consideration*, for the purposes of the Nuclear NPS.

1. Introduction

The Strategic Siting Assessment process

- 1.1 In the White Paper on Nuclear Power¹, the Government set out its belief that it is in the public interest that new nuclear power stations should play a role in the UK's future energy mix alongside other low-carbon sources of electricity. The Government also stated its belief that it would be in the public interest to allow energy companies the option of investing in new nuclear power stations.
- 1.2 The Government also set out a number of 'facilitative actions' that it would undertake to reduce the regulatory and planning risks associated with investment in new nuclear power stations. One of these facilitative actions was to run a Strategic Siting Assessment (SSA) process to identify and assess sites which are suitable for the deployment of new nuclear power stations by the end of 2025².
- 1.3 The Government published a consultation document³ in July 2008 to seek views on the proposed process for inviting and accepting nominations for sites, the proposed process for assessing nominated sites and the proposed criteria for making the assessment. The Government's response to the consultation was published in January 2009⁴, set out the final criteria to be used for assessment (the 'SSA Criteria') and launched the nominations process. A list of the SSA Criteria is included in Appendix A.
- 1.4 In the consultation response, the Government made clear that it recognised the potential significance of early deployment of new nuclear power stations in achieving the UK's objectives on climate change. This means that, although the cut-off date for the SSA is the end of 2025, it saw significant value in early deployment before this date and would have regard to this factor when assessing the suitability of potential sites.
- 1.5 The closing date for nomination of sites for assessment was 31 March 2009 and the Department of Energy and Climate Change (DECC) announced on 15 April that the following 11 sites had been nominated and had met the pre-conditions for consideration as part of the SSA process:
 - Bradwell, Essex;
 - Braystones, Cumbria;
 - Dungeness, Kent;
 - Hartlepool, Durham;
 - Heysham, Lancashire;
 - Hinkley Point, Somerset;
 - Kirksanton, Cumbria;
 - Oldbury, Gloucestershire;
 - Sellafield, Cumbria;
 - Sizewell, Suffolk; and
 - Wylfa, Anglesey.

¹ Meeting the Energy Challenge: a White Paper on Nuclear Power, Department for Business, Enterprise and Regulatory Reform, January 2008

² For the purpose of this document, "deployment of new nuclear power stations" means commencing operation of one or more new nuclear power stations on the site

³ Consultation on the Strategic Siting Assessment Process and Siting Criteria for New Nuclear Power Stations in the UK, Department for Business, Enterprise and Regulatory Reform, July 2008

⁴ Government response to consultations on the Strategic Siting Assessment process and siting criteria for new nuclear power stations in the UK; and to the study on the potential environmental and sustainability effects of applying the criteria, Department of Energy and Climate Change, January 2009

- 1.6 These sites have been assessed against the SSA Criteria by specialists including other Government departments and regulators. In addition, there was a one month opportunity for the public to comment against the criteria on nominated sites. Also an Appraisal of Sustainability has been undertaken that highlights the potential environmental and sustainability effects of siting in accordance with the SSA Criteria, and an Appropriate Assessment has considered the sites from the perspective of the Habitats Regulations Assessment (HRA). Those sites that the SSA process concludes are potentially suitable for deployment by the end of 2025 are being included in the draft National Policy Statement for Nuclear Power Generation (the 'Nuclear NPS'), which is being published for consultation in October 2009. The final Nuclear NPS is expected to be designated in 2010.

Alternatives to nominated sites

- 1.7 The Government has made clear that the SSA is primarily a nomination-driven process. This recognises that industry and other third parties are well placed to identify sites but the SSA will provide an opportunity for the Government to assess the suitability of sites at the national level. It also recognises that suitable sites are likely to have significant commercial value and, accordingly, there may be commercial pressures to identify suitable sites. However, the Government also stated that, to ensure for the various reasons set out in the January 2009 consultation response that alternatives have been sufficiently considered at the strategic level, it would consider whether further steps to consider alternative sites were needed and would reflect the outcome of this when publishing the Nuclear NPS. In particular, the Government said that it would ask nominators how they decided which sites to nominate and would carry out its own study of alternative sites. The purpose of this Study is to support DECC in its consideration of sites for new nuclear power stations that are *worthy of further consideration* as alternatives to the 11 nominated sites. Consequently, the 11 nominated sites have not been assessed as part of this Study. The Study is not, in any way, a substitute for the SSA process: the assessment of nominated sites is able to draw upon detailed information from nominators and responses to the public engagement window, neither of which is available to us. The SSA process also benefits from a much more detailed assessment of the suitability of each nominated site against the SSA Criteria by specialists including other Government departments and regulators than is possible for a national, strategic-level alternatives study.
- 1.8 It is worth recognising that, given enough innovation, effort, time and money, it may be theoretically possible to build, operate and decommission a nuclear power station almost anywhere. This Study is, therefore, not looking to rule out sites as *impossible* from the perspective of siting. In carrying out this Study, we are therefore seeking to identify sites or areas that are *worthy of further consideration* – that is, where in our opinion, the area or site would meet the SSA Criteria. Conversely, areas or sites which, in our opinion, there is a reason to suggest that it would not meet the SSA Criteria, are classified as *not worthy of further consideration*. In making these judgements we are drawing on what is reasonable in terms of good engineering practice, safe and reliable operation, impact on the environment and other established activities.
- 1.9 In identifying an area or site as *worthy of further consideration*, we are signalling that it may have merit as a potential site for the development of one or more new nuclear power stations by 2025, but further thought would need to be given by DECC before any decisions about its suitability could be taken. In identifying a site as *not worthy of further consideration*, we are not irrevocably ruling it out from future development. In putting forward a detailed proposal, an energy company may be able, at some future stage, to conceive actions or steps that minimise or mitigate the concerns that we have identified.

1.10 In coming to our views on sites that are *worthy of further consideration*, we have drawn together three complementary sources of analysis:

- Consideration, through discussions with energy companies and the Nuclear Decommissioning Authority, of the approach they followed to select sites to nominate as part of the SSA process. Where possible, we also discussed with them the sites that they identified as worthy of interest and subsequently declined to nominate, along with the reasons for each such decision.
- Consideration of historic studies and analysis for the siting of nuclear power stations in England and Wales, especially those undertaken by the Central Electricity Generating Board (CEGB) in the 1960s to the 1980s. Recognising that a number of factors including nuclear technology itself, population, amenity and environmental considerations (including understanding of the impact of climate change) have changed very considerably since the time these studies were prepared, we offer in this report a view on the merits of such sites today.
- A screening exercise of the whole of England and Wales (with the exception of the nominated sites themselves), at an appropriate level of detail and in a way consistent with the SSA Criteria, to consider the feasibility of areas and sites. To do this, we developed a Geographical Information System (GIS) database and suitable datasets that allowed us to present information on sites and apply our technical judgement in a clear and robust way.

1.11 More generally, we have not considered alternative non-nuclear solutions to meet the low-carbon energy requirements implicit in the SSA process. Such considerations are a matter for DECC. We have also not considered any areas or sites outside England and Wales, in line with the scope of the SSA itself.

Support in undertaking this Study

1.12 We are indebted to the following for their input and support in undertaking this Study:

- Michael Gammon, who was Head of Generation Development Branch at CEGB from 1977 to 1989 and was a witness at the Sizewell B and Hinkley Point C Inquiries on siting issues. Mr Gammon's specific recollections of sites considered by CEGB are included as part of Chapter 3, but he has contributed to and reviewed the report as a whole.
- Bob Tivey, who was a Senior Planning and Consents Manager at the CEGB between 1978 and 1989 and worked on both the Sizewell B and Hinkley Point C planning applications and Public Inquiries.
- The Health and Safety Laboratory (HSL), who undertook a peer review of the Study, and reached the conclusion that it considers the methodology developed by Atkins to be robust and consistent with best practice for an exercise of this kind.

1.13 We are also appreciative of comments on our methodology from the Health and Safety Executive's Nuclear Directorate, the Environment Agency, the Office for Civil Nuclear Security, the MOD and the Civil Aviation Authority which have helped us ensure that our approach has been as consistent as possible with the SSA process and the assessment of nominated sites.

2. Discussions with nominators and energy companies

Energy companies' processes for selecting sites to nominate

- 2.1 Atkins has interviewed all the organisations that have nominated sites as part of the SSA process and most of the other energy companies that have contributed to and shown an interest in the sites to be nominated. We have also reviewed the responses given by nominators to question A5 on the SSA nomination form. (This question asked nominators to set out the process they followed for selecting the site for nomination, rather than any alternatives, together with the reasons that led them to make that decision.)
- 2.2 For reasons of confidentiality, the identities of the individual companies to whom we spoke are not being disclosed, nor are any comments being attributed to specific companies or particular individuals. We are satisfied that the range of companies interviewed and the frankness and fullness of those discussions have enabled us to gain a reasonably complete picture of the processes used for selecting sites to be nominated and the alternative sites considered and rejected.
- 2.3 Collectively, it is clear that energy companies fall into two categories when it comes to the approach followed. First, a number of energy companies carried out screening exercises to consider potential sites for new nuclear build and these are discussed in more detail below. Secondly, for other companies it was the availability of sites that was the key driver: these companies did not undertake screening exercises but, rather, concentrated on the sites that have become available as a result of the auction of sites by the Nuclear Decommissioning Authority and EDF.
- 2.4 Of the companies that carried out screening exercises, two explained their methodology to us in some detail but declined, for reasons of commercial confidentiality, to mention specific sites. A third not only explained their methodology but also set out, on a site-by-site basis, the shortlist of sites that they considered but decided not to nominate, together with the reasons for each decision.
- 2.5 Factors that energy companies took into account in their screening processes included the following:
- i. Availability of sufficient land (and land use)
 - ii. Demographics
 - iii. Military activities
 - iv. Access to adequate sources of cooling
 - v. Transmission connections (including both length and complexity)*
 - vi. Civil aircraft constraints
 - vii. Supporting infrastructure (e.g. roads, rail and sea access)*
 - viii. Avoidance of topographic and geotechnical issues*
 - ix. Flood protection issues
 - x. Coastal erosion issues
 - xi. Local hazards (proximity to COMAH sites etc)
 - xii. Minimisation of impacts on international environmental designations
 - xiii. Minimisation of impacts on national environmental designations
 - xiv. Minimisation of impacts on areas of high amenity, cultural heritage and landscape value
 - xv. Proximity to development with similar physical and visual impact characteristics+
 - xvi. Proximity to development with similar nuclear use characteristics+
 - xvii. Existing and future planning policy at national and regional level+
 - xviii. Land availability+

- 2.6 All but seven of these factors overlap closely with the SSA Criteria. Three others (marked * above) are included in the SSA process not as exclusionary or discretionary criteria, but rather as ‘flag for local consideration’. A further four (marked + above) are not SSA Criteria and therefore not considered as part of this study, although they may affect deployability by 2025.
- 2.7 While we recognise the robustness of the factors used for their intended purpose – that is, for commercial companies to take business decisions on potential nuclear new build investments – we have two areas of concern:
- Decisions to exclude sites on the grounds of proximity to existing transmission and distribution infrastructure (for example, taking a relatively arbitrary filter of a maximum 10 km distance from an existing 275 kV or 400 kV transmission line) have been taken:
 - in some cases on economic grounds and on the basis of the ease with which consents could be secured; and
 - in circumstances in which it is not practicable to have detailed discussions with National Grid about likely future investment decisions on major strategic Grid upgrades.
 - Some energy companies have given significant weight to the proximity to existing nuclear sites (expressed as factors xv. and xvi. above). There are arguments that it may be easier to secure the necessary consents for a new nuclear power station that is adjacent to an existing nuclear site. Similarly, there are arguments that the action required to minimise or mitigate the visual or other impacts of a new nuclear power station may be easier and more straightforward if there is an existing nuclear facility nearby. However, it seems to us that some energy companies have gone further and have used factors such as xv. and xvi. above, effectively, to rule out alternatives that are not close to existing nuclear sites. (Not all energy companies have done this as the nominations for Braystones and Kirsanton demonstrate.) One reason for this seems to be that energy companies have been mindful of the requirement, as part of the SSA process, to consult local communities before nominating sites. They see considerable importance in securing and maintaining public support from the communities that may be affected by the development of a new nuclear power station. However, proximity to existing sites, public acceptability and distance from existing transmission and distribution infrastructure are not SSA criteria, although the Government does ask nominators to outline the potential timing of any transmission and distribution infrastructure required to make the site operational, as part of its consideration of whether a site was deployable by 2025. They are therefore not used as part of this Study.

- 2.8 Beyond the energy companies themselves, the Nuclear Decommissioning Authority (NDA) also made decisions about which sites to nominate. It undertook a market engagement exercise in March 2008 that sought expressions of interest from energy companies in NDA assets. The NDA was approached by a number of energy companies who were interested in acquiring NDA land at Bradwell, Oldbury, Wylfa and Sellafield and land adjacent to the first three of these sites was put up for auction in March 2009. The NDA submitted nominations for all four sites under the SSA process in January 2009. It is clear that the NDA's decision-making was based on the commercial interest of energy companies and the prospects for securing proceeds from the subsequent auction, rather than any detailed analysis of the strategic suitability of its landholdings for the purpose of developing new nuclear power stations.
- 2.9 It is worth noting that our concerns about energy companies' and the NDA's decision-making centre on the *macro* decisions as to which parts of the country should be considered for new nuclear power stations. We have very few concerns about the process followed by energy companies and the NDA in deciding the precise site to be nominated once they had decided to nominate a particular part of the country. It was clear from our discussions with energy companies that they had clearly considered carefully factors such as the availability of sufficient land, topographical and geotechnical issues, local hazards, flood and coastal erosion issues, international and national designations and amenity, cultural heritage and landscape issues. Indeed, based on our discussions and from the nominations themselves, it seems to us that they have showed considerable awareness of and sensitivity to the requirements of the Habitats Regulations Assessment (HRA) and in most cases where a nominated site is in the vicinity of a Natura 2000 site, they are confident that the location and approach to be followed will not give rise to a significant effect from the perspective of the HRA. (Further considerations would be required when an application for development consent is sought from the Infrastructure Planning Commission or Section 36 consent is sought.) In addition, the SSA assessment process itself has produced a positive dialogue in some cases that has helped to refine the exact location of a nominated site. These two factors together mean that we are content that, from the perspective of an alternatives exercise, the nominations process is superior, in terms of considering the best site to nominate within a particular part of the country, to any consideration we could bring from the perspective of a national level, strategic study.
- Analysis of alternative areas and sites considered and rejected by energy companies**
- 2.10 As only one of the energy companies we interviewed was prepared to share details of the areas and sites it had shortlisted but subsequently decided not to nominate, together with the primary reasons for those decisions, Table 2.1 is an incomplete list of the potential alternative sites that energy companies were considering but decided not to nominate. It is, however, a full list of such sites that were made known to us. In each case, we have come to a view as to whether the site should be considered as *worthy of further consideration* or *not worthy of further consideration* based not only on the information provided by the energy company but also on our own analysis, including the information developed for and derived from the screening exercise set out in Chapter 4.
- 2.11 A map showing the approximate location of alternative areas or sites considered and rejected by energy companies (which are included in Table 2.1) is in Appendix B.

Table 2.1 List of alternative areas or sites considered by energy companies (and disclosed to us) that were not nominated as part of the SSA process

	Location	Primary reasons given by energy companies for the site not being nominated	Atkins' view as to whether the site is <i>worthy of further consideration or not worthy of further consideration</i>	Rationale
E1	East of Llantwit Major to the West of Rhoose	Use	<i>Not worthy of further consideration</i>	Proximity to civil aircraft activities (implementation of an air exclusion area around a new nuclear power station would inhibit air traffic access to Cardiff International Airport).
E2	South of Great Howsden and North of Withersea	Visual impact (no nearby developments with similar physical characteristics) Use	<i>Not worthy of further consideration</i>	Proximity to military activities and potential for coastal erosion over the next 100 years.
E3	East of Amlwch to North of Llanddona	Transmission connection Visual impact AONB	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and size of site (topography).
E4	East of Hartland Point and West of Westward Ho!	Cooling water Transmission Topographic constraints AONB Visual impact Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (cliff height).
E5	East of Heybrook Bay to Thurleston	Cooling water Transmission Topographical constraints AONB Visual impact Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military areas and access to suitable sources of cooling (cliff height).
E6	North of Blyth	Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to civil aircraft activities.
E7	West of Southend-on-Sea	Land availability	<i>Not worthy of further consideration</i>	Flood risk.

	Location	Primary reasons given by energy companies for the site not being nominated	Atkins' view as to whether the site is <i>worthy of further consideration</i> or <i>not worthy of further consideration</i>	Rationale
E8	West of Llanelli to East of Old Castle Head	European designation National designation Visual impact Use	<i>Not worthy of further consideration</i>	Part of the area is excluded due to demographic risks. The remaining area is excluded because of the potential for adverse impact to internationally designated sites and proximity to military activities.
E9	East of Colwyn Bay	Land availability	<i>Not worthy of further consideration</i>	Size of site (topography and land use).
E10	West of Torpoint to East of Looe	Transmission	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (cliff height).
E11	South of Amble and North of Lynemouth	Transmission Visual impact Use	<i>Part of the area is worthy of further consideration</i>	The southern part of the area is not worthy of further consideration due to adverse impact on internationally designated sites and size of site (land use). However, in the northern part of the area (at Druridge Bay and immediate surrounds) there is a site <i>worthy of further consideration</i> . See Appendix H for more detailed assessment.
E12	East of Holyhead	Cooling water National designation AONB Visual impact Use	<i>Not worthy of further consideration</i>	Proximity to exclusionary military activities.
E13	West of Portsmouth	Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
E14	East of Fleetwood	Visual impact	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
E15	North of Faversham to West of Whitstable	Topographical and geotechnics Visual impact Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
E16	North of Holywell	Transmission	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.

	Location	Primary reasons given by energy companies for the site not being nominated	Atkins' view as to whether the site is <i>worthy of further consideration</i> or <i>not worthy of further consideration</i>	Rationale
E17	East of Gravesend	Visual impact Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
E18	West of Folkeston	Land availability	<i>Not worthy of further consideration</i>	Flood risk and size of site (land use).
E19	West of Sheerness	Land availability	Part of the area is <i>worthy of further consideration</i>	The majority of the area is <i>not worthy of further consideration</i> due to potential adverse impact to internationally designated sites and proximity to hazardous facilities. However, the area to the north and west of the existing power station at Kingsnorth is <i>worthy of further consideration</i> . See Appendix H for more detailed assessment.
E20	East of Lymington	Transmission National Park Visual impact Supporting Infrastructure Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
E21	South of Lynemouth and North of Newbiggin-by-the-sea	Transmission Geotechnics Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
E22	South of Port Talbot to Ogmore-by-Sea	Use	<i>Not worthy of further consideration</i>	Part of the area is excluded due to demographic risks. The remaining area is excluded because of the potential for adverse impact to internationally designated sites, proximity to hazardous facilities and size of site (land use).
E23	East of Hartland Point and West of Westward Ho!	Topography National designations Visual impact Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
E24	South of Stratton and East of Padstow	Cooling Water Transmission Supporting Infrastructure Topography AONB Visual impact Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, access to suitable sources of cooling (cliff height) and size of site (topography).

	Location	Primary reasons given by energy companies for the site not being nominated	Atkins' view as to whether the site is <i>worthy of further consideration</i> or <i>not worthy of further consideration</i>	Rationale
E25	Sunk Island	Topography Flood protection Visual impact Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
E26	North of Trwyn y Golech and South of Caernarfon	Visual impact Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
E27	South of Lancaster	Transmission Visual impact	The northern part was not considered and the southern part is <i>not worthy of further consideration</i>	The northern part of this area is close to a site nominated as part of the SSA process so we did not consider it as part of our analysis. The southern part of this area is <i>not worthy of further consideration</i> due to potential adverse impact to internationally designated sites.
E28	East of Milford Haven and West of Old Castle Head	Land availability	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities, proximity to hazardous facilities and access to suitable sources of cooling (cliff height).
E29	East of Prestatyn to North of Mostyn	Geotechnical constraints Local hazards National designations Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
E30	South of Redcar to Saltburn	Land availability	<i>Not worthy of further consideration</i>	Demographic risks.
E31	South of Sunderland and North of Hartlepool	Cooling water Topographic constraints European designations Visual impact Use	<i>Not worthy of further consideration</i>	The majority of the area is excluded due to demographic risks. The remaining area is excluded because of the potential for adverse impact to internationally designated sites.
E32	South of Blyth	Visual impact Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to civil aircraft activities and size of site (land use).
E33	South of Warden Point to South of Isle of Harty	Cooling Transmission Visual impact Use	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).

	Location	Primary reasons given by energy companies for the site not being nominated	Atkins' view as to whether the site is <i>worthy of further consideration or not worthy of further consideration</i>	Rationale
E34	South of Coxhll Haven and North of Grimsby	Topography Local hazards	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to hazardous facilities and size of site (land use).
E35	West of Lulworth to East of Barton Bradstock	Use Transmission Infrastructure Topography European designation National designations AONB Visual impact	<i>Not worthy of further consideration</i>	Part of the area is excluded due to demographic risks. The remaining area is excluded because of the potential for adverse impact to internationally designated sites.
E36	South of Newcastle upon Tyne	Land availability	<i>Not worthy of further consideration</i>	Demographic risks.

Results and conclusions

- 2.12 Table 2.1 shows that, while we did not in a number of cases endorse the reasons given by energy companies for ruling out areas and sites from further consideration, we did agree, with two exceptions, that all of these alternative sites should be regarded as *not worthy of further consideration*. In coming to this view, the factors that cause us to suggest that these alternatives can be discounted (together with the relevant SSA criterion number) are as follows:
- Demographic risk (C1)
 - Proximity to military activities (C2, D5)
 - Flood risk (D1)
 - Coastal erosion or other landscape change scenarios (D2)
 - Proximity to hazardous facilities (D3)
 - Proximity to civil aircraft movements (D4)
 - Internationally designated sites of ecological importance (D6)
 - Proximity to area of amenity cultural heritage and landscape value (D8)
 - Size of site to accommodate operations (D9)
 - Access to suitable sources of cooling (D10)
- 2.13 The two exceptions – that is, the areas in Table 2.1 which we believe are *worthy of further consideration* – are the area surrounding Druridge Bay in Northumberland and part of the area west of Sheerness close to the existing Kingsnorth Power Station.
- 2.14 The main reasons given by the energy company for not considering Druridge Bay further was that it was too far away from a Grid transmission line, there would be an adverse visual impact on an area of high amenity value and it was not close to development of similar use characteristics. (There were other secondary reasons but the energy company indicated that these three were the most important.)
- 2.15 Druridge Bay site is approximately 14 km from the 400 kV line at Rothbury and approximately 10 km from the 275 kV line at Blyth. Given the SSA Criteria set out above, we do not believe that distance from transmission infrastructure on its own is a sufficient reason to regard Druridge Bay as *not worthy of further consideration* although the Government does ask nominators to set out the time-scale for related investment in transmission and distribution infrastructure in the SSA.
- 2.16 In terms of giving significant weight to sites that are close to a development with similar physical and visual impact characteristics or with similar nuclear use characteristics, while it may be easier to make the case for development at such sites, we believe that this is not a sufficient reason to rule out sites that are not close to existing (or former) nuclear power stations.

- 2.17 In terms of amenity value, Druridge Bay is part of the Northumberland Heritage Coast although it is not within the Northumberland coast Area of Outstanding Natural Beauty (AONB) which stops at Coquet Estuary some 5 km to the north. This lack of formal AONB status makes it difficult for us to endorse visual impact as a sufficient reason for Druridge Bay not to be regarded as suitable for the development of a new nuclear power station. However, we do note its Heritage Coast status and that part of the land is owned by the National Trust.
- 2.18 The main reason given by the energy company for not considering the area west of Sheerness is land availability. This may be a general comment on whether there is sufficient land available to build a new nuclear power station, in which case we would disagree with it as we think there is sufficient land available to the north and west of Kingsnorth Power Station. (This area is far enough away from the LNG facility on the Isle of Grain for this not to be an issue.) The comment may also take into account the likelihood of the particular energy company being able to acquire the land in question, which would be an entirely legitimate commercial consideration for them, but not for the Study as a whole. Details of the area close to Kingsnorth Power Station that we believe is *worthy of further consideration* are set out in Appendix H. Development of a new nuclear power station within this location is far from straightforward as there are issues over the high surrounding population and proximity to internationally designated sites to overcome.
- 2.19 It is clear that there is no interest from any energy company in developing a new nuclear power station at either Druridge Bay or Kingsnorth. There is similarly no interest at other non-nominated sites including Owston Ferry, the other area to emerge from our screening exercise as *worthy of further consideration* (see Chapter 4). It seems clear that no recent site analysis or preparation work has been done at these three sites and that it is therefore reasonable to conclude that the impact on deployment (and therefore delay) could be significant.

3. Historic studies of suitable nuclear sites

- 3.1

It is clear that extensive work has been done in the 1960s, 1970s and early 1980s by the Central Electricity Generating Board and others in identifying suitable sites for new nuclear power stations. While technology, reactor size and type and other factors (including ecological designations and awareness of climate change) have moved on considerably since this period, a review of the CEBG and other relevant historic studies is nevertheless a valuable starting point for any study of alternatives.
- 3.2

We have carried out a review of the available literature in relation to nuclear siting. We have been assisted in this exercise by current staff at NDA, BNFL, British Energy, DECC and NII and several former members of staff at CEBG, for which we are very grateful.
- 3.3

Our literature search has revealed the sources of information in Table 3.1 as the most relevant for identifying alternative sites that had been considered at some point for the development of new nuclear power stations. It is important to note that many of these sites were not considered further as sites for nuclear development due to the effect of a change in national policy in 1988⁵ which allowed the use of gas for generation purposes.

Table 3.1 Sources of information for alternative sites from historic studies

	Source	Date(s)	Origin	Reference(s) for specific documents	Comments or note
A	Portskewett Public Inquiry documents	1971 to 1972	National archives	POWE14/1587 Portskewett Nuclear Power Station: Extract from, 'Proofs of Evidence and other Documents from Public Enquiry'. Section 9: Summary of Objections	Includes proofs of evidence, letters of objection and other documentation.
B	CEGB and NII correspondence and meeting notes on nuclear siting issues	1971 to 1976	National archives	POWE74/394 Siting of Nuclear Power Stations. (Various meeting notes between CEBG and NII and DTI briefings on nuclear site consent requirements)	Site investigations were underway by the CEBG at this time, and a report in relation to planning consents for prospective nuclear sites includes some consideration of these sites and the NII's remote siting criteria. These sites are listed and identified on a location map, which includes existing nuclear sites and new, greenfield sites, along with a brief comment on the merits of each site.

⁵ Privatising Electricity, Department of Energy, 1988

	Source	Date(s)	Origin	Reference(s) for specific documents	Comments or note
C	Publicly available CEBG papers	1980 to 1982	Public sources	<p>CEGB Press Information: Electricity Supplies in the South West; Power Station Site Investigations</p> <p>CEGB Press Information: South-West Power Station Study Completed; Future Possible Sites in England Named</p> <p>CEGB Leaflet: Druridge – Site for Possible Nuclear Power Station</p> <p>Druridge Bay – Nuclear Power Station Site Investigation</p>	
D	Discussions between CEBG and NII (1985) and NII records from c.1985	1985	NII	<p>Minutes of Informal meeting between CEBG (Planning and HSD) and NII on 12 July 1985 plus a letter with comments on the CEBG minutes of the meeting</p> <p>CEGB Prospective Power Reactor Sites – NII file list undated but believed to be from around 1985 (although files themselves believed to be destroyed)</p>	This lists a large number of potential sites, along with the CEBG's future development preferences, and interest in particular sites. Sites identified as: development within 5 years; development within 10 years; those which may be of future interest; and those in which the CEBG were no longer interested.
E	Sizewell and Hinkley Public Inquiries	1982 to 1992	Publicly available	<p>Sizewell B Inquiry: CEBG Proof of Evidence P1 On: CEBG Policy by J W Baker</p> <p>Sizewell B Inquiry: CEBG Proof of Evidence P25 On: Site Selection and Site Specific Aspects by K M Gammon</p> <p>Sizewell B Public Inquiry – Report by Sir Frank Layfield. DoE</p> <p>Proposed Hinkley Point 'C' PWR Power Station: Environmental Statement</p> <p>Hinkley Point 'C' Power Station Public Inquiry: Statement of Case</p> <p>Proposed Sizewell 'C' PWR Power Station: Environmental Statement - Chapter 4</p>	

	Source	Date(s)	Origin	Reference(s) for specific documents	Comments or note
F	BNFL Board Paper	1990	BNFL	New reactors for BNFL; Report of the Feasibility Study	BNFL carried out feasibility studies for new nuclear generation for the Sellafield and Chapelcross sites, although some alternative sites are considered in a comparative context.
G	British Energy privatisation land allocation	1996	DECC (former DTI files)	NNP17 Land Allocation Correspondence - Outstanding Issues	Documentation relating to land and property allocation between Magnox Electric and British Energy identifies some "potential power station sites".

3.4 In addition, we have had the benefit of detailed discussions with Michael Gammon who was Head of Generation Development Branch at CEGB from 1977 to 1989 and a witness at the Sizewell B and Hinkley Point C Inquiries on siting issues. His recollections are included in Table 3.2 as source GAMMON.

3.5 We have also taken account of published sources that are relevant to nuclear siting from professional bodies, consultants and academics. In particular, we have drawn upon information from:

- Chapters 2 and 5 of Nuclear Power, Siting and Safety⁶ by Stan Openshaw
- The Jackson Report⁷
- ICE Journal – *The Selection and Investigation of Potential Nuclear Power Station Sites in Suffolk*⁸.

Together, the information on sites from this material is included in Table 3.2 as Source O.

3.6 In relation to Druridge Bay, we were also able to draw on information from *Generating Pressure, the Campaign against Nuclear Power at Druridge Bay*⁹ by Bridget Gubbins.

3.7 Table 3.2 shows the alternative sites that each source has suggested were under consideration at some stage for the development of a new nuclear power station. (Listing a site in this table does not indicate that it was suitable or preferred, just that it was considered.)

⁶ Nuclear Power, Siting and Safety, Stan Openshaw (1986), Routledge & Kegan Paul, London

⁷ Siting New Nuclear Power Stations: Availability and Options for Government, Ian Jackson and Shehnaz Jackson (2006), available at <http://www.berr.gov.uk/files/file39030.pdf>

⁸ K M Gammon, G F Pedgrift, F H E Myers and E Usher (1962), The Selection and Investigation of Potential Nuclear Power Station Sites in Suffolk, ICE Proceedings, Volume 23, Number 4, pages 790–792

⁹ Generating Pressure, the Campaign against Nuclear Power at Druridge Bay, Bridget Gubbins (1991), Earthright Publications, Tyne & Wear

- 3.8

Nine sites in this list have been nominated as part of the SSA process and therefore fall outside the scope of this Study. They have been omitted from Table 3.3 below.
- 3.9

Analysis of alternative sites identified from historic studies

For each of the sites in Table 3.3 below, we have considered whether the site should be considered as *worthy of further consideration* or *not worthy of further consideration* based not only on the information contained in the historic sources but also on our own analysis, including the information developed for and derived from the screening exercise set out in Chapter 4. For six of these historic sites, for the reasons outlined in paragraph 4.10, we do not consider these further against our own screening process. A map showing the 69 alternative sites from historical sources for which we can be clear about the location is included in Appendix C. Some of these sites went on to be developed for non-nuclear electricity generation purposes.

Table 3.3 List of alternative sites from historic studies and their suitability for the development of a new nuclear power station by 2025

	Name/Site	Indication of feasibility from historic studies	Atkins' view as to whether site is worthy of further consideration or not worthy of further consideration	Rationale
H1	Amcotts South of Burton upon Stather	[D 1985] CEGB interested in Humberside sites.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H2	Aust North of Bristol	[B 1972] Exceeds remote siting criteria. Portskewett preferred. [D 1985] CEGB still interested in site for future possibilities.	This site has not been considered as it is close to a site nominated as part of the SSA process (Oldbury).	
H3	Berkeley South West of Gloucester	[B 1972] No development potential. Limitation on cooling water.	This site has not been considered as it is close to a site nominated as part of the SSA process (Oldbury).	
H5	Burn/Selby South of York	[D 1985] CEGB no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.
H6	Carmel Head Anglesey	[D 1985] CEGB still interested in site for future possibilities.	<i>Not worthy of further consideration</i>	Land use (topography) and potential adverse impact to areas of amenity.
H7	Boyton Hall/ Cauldwell Hall Suffolk	[O 1962] Difficulties with cooling water.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H8	Claydon West Milton Keynes	[GAMMON 2009] Not pursued further by CEGB in late 1980s following feasibility studies indicating limited and very remote cooling water.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.

	Name/Site	Indication of feasibility from historic studies	Atkins' view as to whether site is worthy of further consideration or not worthy of further consideration	Rationale
H9	Cliffe Marsh North of Chatham	[B 1972] Exceeds proposed siting criteria. [D 1985] CEGB considering developing within 10 years.	<i>Not worthy of further consideration</i>	Within internationally designated sites.
H10	Colyton North of Seaton	[GAMMON 2009] Not pursued further by CEGB in late 1980s following feasibility studies indicating difficulties in getting enough cooling water for direct cooling and population.	<i>Not worthy of further consideration</i>	Demographics risk and access to suitable sources of cooling.
H11	Connah's Quay South of Liverpool	[B 1972] Connah's Quay nuclear license application rejected after public inquiry due to conflicts with Deeside development. [D 1985] CEGB no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, access to suitable sources of cooling and size of site (land use).
H12	Cottam East of Retford	[D 1985] CEGB considering developing within 10 years.	<i>Not worthy of further consideration</i>	Proximity to civil aircraft activities and size of site (land use).
H13	Covehithe South of Beccles	[O 1962] Significant coastal and sea bed erosion found during Suffolk coast investigations including Sizewell. Not put forward as prospective site, Sizewell preferred.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H14	Denver South of Downham Market	[B 1972] Limited cooling water supplies. [D 1985] CEGB considering within 10 years.	<i>Not worthy of further consideration</i>	Proximity to military activities and access to suitable sources of cooling.
H15	Dibden South West of Southampton	[GAMMON 2009] Not pursued further by CEGB in late 1980s following feasibility studies indicating poor ground conditions, population and conflicts with local development.	<i>Not worthy of further consideration</i>	Demographic risks.
H16	Didcot South of Oxford	[D 1985] CEGB still interested in site for future possibilities.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.

	Name/Site	Indication of feasibility from historic studies	Atkins' view as to whether site is worthy of further consideration or not worthy of further consideration	Rationale
H17	Druridge North of Blyth	<p>[C 1982] CEBG identified Druridge Bay as suitable for PWR with direct cooling. No anticipated impact on fisheries. Listed as one of five possible sites for next application following Hinkley.</p> <p>[D 1985] CEBG intending to develop within 5 years, nearby prison and coal mine noted.</p> <p>[E 1982-92] Suitable for 2 x 1300 MW PWR reactors, although significant transmission installation and re-enforcement required.</p> <p>[G 1996] Listed as potential power station site during privatisation of CEBG in 1990s.</p>	<i>Worthy of further consideration</i>	At Druridge Bay and the surrounding area there is a site <i>worthy of further consideration</i> . See Appendix H for more detailed assessment.
H19	Dunwich North of Sizewell	[O 1962] Considerable excavation required.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H20	Earnley/Selsey South of Chichester	[D 1985] CEBG no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and flood risk.
H21	East Yelland West of Barnstaple	[C 1982] Existing, small coal-fired station due for closure shortly, not considered suitable by CEBG for re-development as nuclear site.	<i>Not worthy of further consideration</i>	Proximity to military activities and access to suitable sources of cooling (periods of low fluvial flow).
H22	Edern South of Morfa Nefyn	<p>[B 1972] Meets remote siting criteria, although amenity and transmission difficulties noted.</p> <p>[D 1985] CEBG still interested in site for future possibilities, although geological fault noted.</p>	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.

	Name/Site	Indication of feasibility from historic studies	Atkins' view as to whether site is worthy of further consideration or not worthy of further consideration	Rationale
H23	Elstow South of Bedford	[B 1972] Exceeds proposed siting criteria. [D 1985] CEGB no longer interested in the site for nuclear development. [GAMMON 2009] Not pursued further by CEGB in late 1980s following feasibility studies indicating difficulties in getting enough cooling water.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.
H24	Erwarton Ness North of Harwich	[O 1962] Deep water channel into the Ness seemed to have sufficient thermal capacity, following Suffolk coast investigations including Sizewell. Not put forward as prospective site, Sizewell preferred. [D 1985] CEGB no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H25	Fawley South of Southampton	[D 1985] CEGB considering developing within 10 years, although assessment of nearby industrial hazards required. [B 1972] Exceeds proposed siting criteria - 5 miles from Southampton.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
H27	Goldcliff South of Newport	[A 1972] Possible alternative to Portskewett. Not considered suitable as area of site too small, foundation problems and difficulties in access to suitable sources of cooling water.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H28	Guyhirn East of Peterborough	[GAMMON 2009] Not pursued further by CEGB in late 1980s following feasibility studies indicating limited cooling water supply and conflicts with local industry.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.

	Name/Site	Indication of feasibility from historic studies	Atkins' view as to whether site is worthy of further consideration or not worthy of further consideration	Rationale
H29	Gwithian West of Redruth	[C 1982] Not considered further for nuclear development by CEGB after site investigations indicated poor ground conditions. [D 1985] CEGB no longer interested in the site for nuclear development. [E 1987] Ruled out by CEGB due to unsuitable geological conditions for nuclear development.	<i>Not worthy of further consideration</i>	Proximity to military activities.
H30	Hams Hall East Birmingham	[D 1985] Not acceptable under present siting policy, CEGB still interested in site for future possibilities.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.
H31	Hamstead Isle of Wight	[D 1985] CEGB no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H32	Happisburgh North East of Norwich	[GAMMON 2009] Desk studies and consultations indicated the site not worthy of further consideration by the CEGB in late 1980s for nuclear development due to population concerns.	<i>Not worthy of further consideration</i>	Coastal erosion over the next 100 years.
H34	Herbury North West Weymouth	[C 1982] Site investigations indicate site technically suitable, although strong concerns regarding impact on natural beauty and ecology of the area. Not considered further by CEGB. [D 1985] CEGB still interested, although holiday population concerns. [E 1987] Technically suitable. Not considered further by CEGB for nuclear development due to impact on amenity and environment.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H36	High Burnham West of Owston Ferry	[D 1985] CEGB expressed interest in Humberside sites for the future.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.
H37	High Marnham West Lincoln	[D 1985] CEGB no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Civil aircraft activities and size of site (land use).

	Name/Site	Indication of feasibility from historic studies	Atkins' view as to whether site is worthy of further consideration or not worthy of further consideration	Rationale
H39	Ince East of Ellesmere Port	[D 1985] CEGB no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H40	Inswork Point South West of Plymouth	[B 1972] Nuclear license application failed on nuclear safety grounds. [D 1985] Exceeds remote siting criteria. CEGB still interested in site for future possibilities.	<i>Not worthy of further consideration</i>	Within an internationally designated site.
H41	Keadby North of Scunthorpe	[B 1972] Cooling water abstraction from the Trent would require cooling towers. [D 1985] CEGB still interested in site for future possibilities.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and flood risk (sequential test).
H42	Kelling West of Cromer	[D 1985] CEGB no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
H43	Killingholme North West of Grimsby	[B 1972] Put forward by CEGB, oil refinery and tankers may require additional containment. [D 1985] CEGB intending to develop within 10 years, oil refinery nearby. CEGB may consider coal-fired station.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to hazardous facilities and size of site (land use).
H44	Kingsnorth North of Gillingham	[D 1985] CEGB considering developing within 10 years.	<i>Worthy of further consideration</i>	The area to the north and west of the existing power station at Kingsnorth is <i>worthy of further consideration</i> . See Appendix H for more detailed assessment.
H45	Landguard Point South of Felixstowe	[GAMMON 2009] Not pursued further by CEGB in late 1980s following feasibility studies indicating development of Felixstowe Docks, and population concerns.	<i>Not worthy of further consideration</i>	Size of site (land use).
H47	Lligwy West of Moelfre	[D 1985] CEGB no longer interested in the site for nuclear development, holiday populations noted.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and size of site (topography).
H48	Lune Foreshore South of Heysham	[D 1985] CEGB still interested in site.	This site has not been considered as it is close to a site nominated as part of the SSA process (Heysham).	

	Name/Site	Indication of feasibility from historic studies	Atkins' view as to whether site is worthy of further consideration or not worthy of further consideration	Rationale
H49	Luxulyan North of St Austell	[C 1982] CEGB site investigations indicated technically suitable, although strong concerns regarding visual impact and costs. [D 1985] CEGB still interested in site for future possibilities. [E 1987] Technically suitable for nuclear development, although strong concerns regarding visual impact and costs.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.
H50	Millom East of Haverigg	[D 1985] CEGB no longer interested in the site for nuclear development	This site has not been considered as it is close to a site nominated as part of the SSA process (Kirksanton).	
H51	Molesworth East of Wellingborough	[D 1985] CEGB no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.
H52	Much Hoole South West of Preston	[D 1985] CEGB no longer interested in the site for nuclear development, population concerns.	<i>Not worthy of further consideration</i>	Proximity to military activities.
H53	Nancekuke North of Redruth	[C 1982] Not considered further for nuclear development by CEGB after site investigations indicated poor ground conditions. [D 1985] CEGB no longer interested in the site for nuclear development due to geological conditions. [E 1987] Ruled out by CEGB due to geological conditions.	<i>Not worthy of further consideration</i>	Proximity to military activities.
H54	North Coates South East of Grimsby	[B 1972] Preliminary investigations only. CEGB identified as possibly an alternative to Killingholme. [D 1985] CEGB no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
H56	Orford Ness North East of Felixstowe	[D 1985] CEGB still interested in site for future possibilities.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H57	Owston Ferry South West of Scunthorpe	[B 1972] Cooling water abstraction from the Trent would require cooling towers. [D 1985] CEGB expressed interest in Humberside sites for the future.	<i>Worthy of further consideration</i>	There are areas near Owston Ferry that are <i>worthy of further consideration</i> . See Appendix H for more detailed assessment.

	Name/Site	Indication of feasibility from historic studies	Atkins' view as to whether site is worthy of further consideration or not worthy of further consideration	Rationale
H58	Pembroke East of Pembroke Dock	[GAMMON 2009] Desk studies and consultations indicated the site not worthy of further consideration by the CEBG in late 1980s for nuclear development. [G 1996] Listed as potential power station site during privatisation of CEBG in 1990s.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and proximity to hazardous facilities.
H60	Point Lynas North of Anglesey	[D 1985] CEBG no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Size of site (topography).
H62	Portland South of Weymouth	[D 1985] CEBG no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Demographic risks.
H63	Portskewett South West of Chepstow	[A 1972] One other alternative site in Monmouthshire considered - Goldcliff. Portskewett technically preferred. [B 1972] Marginally exceeds remote siting criteria, preferred to Aust. CEBG anticipate consent application by 1974. [D 1985] CEBG request for renewed application withdrawn in 1980. CEBG considering developing within 10 years.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H66	South Ferriby West of Barton-upon-Humber	[D 1985] CEBG expressed interest in Humberside sites for the future.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H67	Stourport West of Stourport-on-Severn	[A 1972] Nuclear consent rejected due to population. [B 1972] Nuclear consent failed on nuclear safety grounds. [D 1985] CEBG no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.
H68	Sutton Bridge West of King's Lynn	[GAMMON 2009] Not pursued further by CEBG in the late 1980s following feasibility studies indicating limited cooling water source and poor ground conditions.	<i>Not worthy of further consideration</i>	Proximity to military activities.

	Name/Site	Indication of feasibility from historic studies	Atkins' view as to whether site is worthy of further consideration or not worthy of further consideration	Rationale
H70	Tempsford South of St Neots	[GAMMON 2009] Not pursued further by CEGB in the late 1980s following feasibility studies indicating limited cooling water source and population.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.
H71	Tidenham North East of Chepstow	[D 1985] CEGB no longer interested in the site for nuclear development.	This site has not been considered as it is close to a site nominated as part of the SSA process (Oldbury).	
H72	Toddington North of Luton	[GAMMON 2009] Not pursued further by CEGB in the late 1980s following feasibility studies indicating limited and remote cooling water source.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.
H73	Trawsfynydd Snowdonia National Park	[B 1972] Limited cooling water and transmission problems. [D 1985] CEGB considering development within 5 years. [E 1988] Site for PWR identified 1.5 km North West of the existing station within the Snowdonian National Park. Extension of the Llyn Trawsfynydd to about twice its current capacity would provide adequate cooling water.	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling.
H74	Trefadog North of Holyhead	[D 1985] CEGB no longer interested in the site for nuclear development.	This site has not been considered as it is close to a site nominated as part of the SSA process (Wylfa).	
H75	Tunstall Cliffs North of Withernsea	[D 1985] CEGB expressed interest in Humberside sites for the future.	<i>Not worthy of further consideration</i>	Coastal erosion over the next 100 years.
H76	Waxham North of Hemsby	[D 1985] CEGB no longer interested in the site for nuclear development.	<i>Not worthy of further consideration</i>	Coastal erosion over the next 100 years.
H77	West Burton South of Gainsborough	[B 1972] Cooling water abstraction from the Trent would require cooling towers. [D 1985] CEGB still interested in site for future possibilities.	<i>Not worthy of further consideration</i>	Proximity to civil aircraft activities and size of site (land use).

	Name/Site	Indication of feasibility from historic studies	Atkins' view as to whether site is worthy of further consideration or not worthy of further consideration	Rationale
H78	Weybourne West of Sheringham	[B 1972] Remote site and possible alternative to Sizewell. New transmission lines required. [D 1985] CEBG still interested in site for future possibilities but concerns over large holiday population.	<i>Not worthy of further consideration</i>	Size of site (land use).
H79	Whale Island North of Portsmouth	[GAMMON 2009] Not pursued further by CEBG in the late 1980s following feasibility studies indicating poor ground conditions, population and land owned by MOD.	<i>Not worthy of further consideration</i>	Demographic risks.
H80	Winfrith Heath South East of Dorchester	[C 1982] Site investigations indicated technically suitable, although strong concerns regarding impact on ecology of the area and CEBG favoured Winfrith UKAEA site. Not considered further by CEBG. [D 1985] CEBG no longer interested in the site for nuclear development. [E 1987] Technically suitable for PWR, although CEBG preferred Winfrith UKAEA site.	<i>Not worthy of further consideration</i>	Within an internationally designated site and access to suitable sources of cooling.
H81	Winfrith South South East of Dorchester	[GAMMON 2009] Not pursued further by CEBG in late 1980s following feasibility studies due to proximity to MOD firing range.	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
H82	Winfrith UKAEA South East of Dorchester	[C 1982] CEBG listed as one of four possible sites for next nuclear application following Hinkley. [E 1987] Technically suitable for PWR, site preferred to Winfrith Heath for ecological reasons. One of several possible sites for next nuclear application following Hinkley. [GAMMON 2009] Not pursued further by CEBG in the late 1980s following feasibility studies due to requirement for cooling towers with a saltwater make-up.	<i>Not worthy of further consideration</i>	Within an internationally designated site and access to suitable sources of cooling.

Results and conclusions

3.10 Table 3.3 shows that, whereas a number of alternatives were regarded as feasible and actively considered for the development of new nuclear power stations in the 1980s, very few of those alternatives are *worthy of further consideration* today. In coming to this view, we have considered each site from the perspective of the SSA Criteria. In all but three cases we believe that it is reasonable to conclude that the alternatives from historic sources should be regarded as *not worthy of further consideration* and factors that have allowed us to come to this view (including the relevant SSA criterion number) are as follows:

- Demographic risk (C1)
- Proximity to military activities (C2, D5)
- Flood risk (D1)
- Coastal erosion and other landscape change scenarios (D2)
- Proximity to hazardous facilities (D3)
- Proximity to civil aircraft movements (D4)
- Internationally designated sites of ecological importance (D6)
- Proximity to area of amenity cultural heritage and landscape value (D8)
- Size of site to accommodate operations (D9)
- Access to suitable sources of cooling (D10)

3.11 The three exceptions – that is, the alternative sites from historical sources that we believe are *worthy of further consideration* – are:

- Druridge Bay in Northumberland. It is clear from the CEGB Site Investigation document from 1980 that a reasonable amount of detailed consideration was given to the feasibility of the Druridge Bay site (including site surveys, meteorological conditions, water supplies, drainage, cooling water, site access and foundation conditions, much of which is still relevant today). Druridge Bay was also identified in the memorandum of 12 July 1985 as one of six sites (along with Hinkley Point C, Winfrith, Dungeness, Sizewell and Trawsfynydd or Wylfa) that the CEGB wished to develop within five years.
- Kingsnorth in Kent. There is a limited amount of information on this site in the historic literature, although it was identified in the memorandum of 12 July 1985 as a site which CEGB thought they might be considering within the next 10 years.
- Owston Ferry in Lincolnshire. The site is mentioned in correspondence between the CEGB and NII in January 1972, which identifies that the site is within the demographic siting criteria and as the cooling water source will be the River Trent, cooling towers will be required. The site is also identified in the discussions between CECB and the NII in 1985.

4. Screening exercise for England and Wales

Methodology – Principles

- 4.1 The third element of our Study is a screening exercise of the whole of England and Wales, at an appropriate level of detail and in a way consistent with the SSA Criteria, to establish the existence or otherwise of alternative sites to those nominated that could be *worthy of further consideration*.
- 4.2 The methodology for the Study is based on five key principles:
1. It is based closely on the application of the SSA Criteria to the whole of England and Wales (with the exception of the 11 nominated sites, recognising that some adaptation of the criteria is needed to allow them to be applied to an alternatives exercise, rather than an assessment of nominated sites.
 2. It is non-prescriptive in that it relies on the judgement of competent technical experts, rather than hard and fast rules on the reasons to rule sites in and out. Different experts on the basis of different information could make different judgements.
 3. It builds in a 'reasonableness test' – that is, in considering each criteria, the technical experts will address, amongst other things, what is reasonable from the perspective of good engineering practice, safe and reliable operation, and influence of the proposal on the environment and other established activities so as to rule out areas and sites that are unreasonable.
 4. It gives due regard to the potential for the mitigation actions and counter-measures that an energy company might reasonably have suggested if a site had been nominated as part of the SSA process, while recognising that such mitigations and counter-measures are hypothetical and we cannot anticipate what technological solutions energy companies might be able to put forward.
 5. It is not intended to be a substitute for the SSA process itself which has been designed to assess whether sites are suitable for the deployment of new nuclear power stations by the end of 2025. Rather, we are seeking to identify sites or areas that are *worthy of further consideration* – that is, where in our opinion, the area or site would meet the SSA Criteria. Conversely, areas or sites which, in our opinion, there is a reason to suggest that it would not meet the SSA Criteria, are classified as *not worthy of further consideration*.

Whether sites are actually considered further is not a matter for us and there may be a variety of factors outside the scope of this Study that would be legitimate reasons why such sites should not be taken forward.

Methodology – Stage 1

4.3 Stage 1 of the methodology begins by the application of two exclusionary criteria (demographic risk (C1) and exclusionary military activities (C2)) to the whole of England and Wales (with the exception of the 11 nominated sites). The treatment of the two exclusionary criteria in our Study is as follows:

- The demographics screening was achieved using the National Population Database (provided by the Health and Safety Laboratory) to calculate for each 500 m by 500 m grid square across the whole of England and Wales, whether it meets the Semi-Urban criterion^{10,11}. This Semi-Urban criterion is based upon a form of cumulative weighted population out to various distances all around the site and in any 30 degree sector. To assess a site against the criterion at a certain distance, the population for a given distance band is multiplied by an appropriate weighting factor and the values up to the distance being evaluated are added together. The results of this approach are shown in Appendix D1.
- The exclusionary military activities were based on the set of activities identified in the SSA criteria. This criterion has the dual purpose of seeking to avoid the potential external hazards to nuclear power station safety that could be created by military training and to ensure that the capabilities of the armed forces to carry out essential training and operations are not adversely affected by the siting of new nuclear power stations. Where information was available from MOD, the areas in question were digitised onto maps at 1:250,000 scale. The results of this approach are shown in Appendix D2.

4.4 Application of these two exclusionary criteria rules out 29% of England and Wales and the remaining 107,000 km² is too large an area to screen manually. We therefore adapted three of the SSA discretionary criteria to allow automatic screening using national datasets:

- We adapted criterion D6 (proximity to internationally designated sites of ecological importance) to rule out areas if they were located actually within an internationally designated site. We believe this is reasonable as it will be very difficult to argue, given the inevitable disruption due to construction and operation, that there will be no negative effect on such sites if a new nuclear station is actually located within the designation.
- We adapted criterion D9 (size of site to accommodate operations) to give a minimum size for the areas we consider further later in the Study. There were three categories of area:
 - All sites less than 0.3 km² were rejected as insufficient lands for 'defence-in-depth';
 - All sites greater than 1 km² pass to Stage 2
 - Those sites between 0.3 km² and 1 km² were looked at in more detail and if sufficient surrounding land was available for 'defence in depth'. they passed to Stage 2.

¹⁰ See pages 55-59 of Towards a Nuclear National Policy Statement - Consultation on the Strategic Siting Assessment Process and Siting Criteria for New Nuclear Power Stations in the UK, BERR, July 2008.

¹¹ Highton, J and Senior, D, The Siting of Nuclear Installations in the United Kingdom, Nuclear Safety Advisory Committee Discussion Paper, July 2008, available at <http://www.hse.gov.uk/aboutus/meetings/iacs/nusac/030708/p12-sittingpaper.pdf>

There were 261 areas greater than 1 km² in size and these passed through automatically to Stage 2. There were 80 areas between 0.3 km² and 1 km² in size. Of these, nine passed through to Stage 2 as they had sufficient suitable land for 'defence-in-depth'. Table E3.1 shows our analysis of these 80 areas and Appendix E3 sets out the background to our assumptions relating to size of site and 'defence-in-depth' in more detail.

- We adapted criterion D10 (access to suitable sources of cooling) to exclude parts of the country that were more than 2 km away from a significant body of water (which we took to be at a coastal location or certain river-based locations with significant flow rates capable of providing cooling water to a nuclear power station). A more detailed description of this approach is given in Appendix E2.

4.5 With these additional steps, Stage 1 was able to rule out 95% of England and Wales and the remaining 5% (some 7,500 km²), although large, lends itself to a manual screening exercise, albeit one that requires judgements to be made on the basis of national- and strategic-level information. The 7,500 km² was made up of 270 separate areas around the coast and major rivers: the smallest was 0.4 km² in size and the largest was 333 km².

Methodology – Stage 2

4.6 We assembled a team of competent experts to make technical judgements on the 270 areas that passed Stage 1 of our methodology. We used a GIS database which included graphical information that was relevant to the SSA Criteria and aided the way the experts were able to reach their judgements.

4.7 Some of the criteria did not lend themselves to the development of national datasets and required manual and detailed scrutiny of reports and other supporting material which was time-consuming and difficult. Once we had identified that a site or area out was *not worthy of further consideration* due to issues against a criterion, we did not necessarily consider it further against the other criteria. It may therefore be that the reasons we give in our report as to why a site or area is *not worthy of further consideration* are not the only reasons why one could come to that conclusion.

4.8 Table 4.1 below sets out the methodology we followed in relation to the adaptation of each of the SSA discretionary criteria to this alternatives exercise. Appendix A sets this out across all the criteria.

Table 4.1 Adaptation of the SSA discretionary criteria to this Study

Criterion	Approach
Flood risk (D1)	<p>Flooding from rivers and coastal waters is a natural process which plays an important role in shaping the natural environment. Flooding can threaten lives and can cause substantial damage to property and infrastructure. The possible effects of flooding may have a major bearing on the safety of a nuclear power station and the presence of water may be a common cause of failure for safety-related systems.</p> <p>Flooding can come from rivers and the sea, sea surges, directly from rainfall on the ground surface and from rising groundwater, overwhelmed sewers and drainage systems. All new developments in England, including infrastructure such as new nuclear power stations, must take due account of the policies set out in Planning Policy Statement 25 (PPS 25). PPS 25 outlines how flood risk should be considered in making planning decisions. In Wales, there is a separate Planning Policy Wales Technical Advice Note (TAN) 15: Development and Flood Risk.</p> <p>We used the principles set out in PPS 25 and TAN 15 together with the national flood risk maps produced by the Environment Agency to help make decisions on the sites. In particular, we considered whether it was reasonable to conclude that a proposal to develop a new nuclear power station on the area or site would be safe, not increase flood risk elsewhere and, where possible, reduce flood risk overall taking into account reasonable possible mitigation measures. This is difficult to do on the basis of national-, strategic-level information and in the absence of specific proposals on mitigation measures from energy companies. The sites and areas we have excluded as not worthy of further consideration on this basis are therefore at reasonably severe risk of flooding and, in our professional judgement, it will be difficult to show that they would pass the Exception Test. In coming to this view, we are not setting our judgement above that of the Environment Agency but, in the context of an alternatives study, we need to make judgements on the sites and areas that we believe should be considered further.</p> <p>Where appropriate, we have also considered whether sites and areas would be likely to pass the Sequential Test and, in particular, whether there are likely to be reasonably available sites at a lower flood risk appropriate to the type of development proposed.</p> <p>The parts of the country most at risk of flooding are shown on the map in Appendix D5. This shows:</p> <ul style="list-style-type: none"> • Flood Zone 3 – land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. • Flood Zone 2 – land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1%–0.1%) or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5%–0.1%) in any year.

Criterion	Approach
Coastal processes (D2)	<p>Given the nature of nuclear power stations, it is reasonable that the effects of coastal processes, including the potential effects of climate change, should be considered over a minimum time horizon of 100 years. This then reflects Defra Outcome Measure 9 'Long term policies and action plans' which recommends looking at beyond the 100 year time horizon.</p> <p>There is currently no complete national dataset showing forecast coastal erosion that is available for use in this Study. The current EA Making Space for Water – HA4b National Coastal Erosion Risk Mapping study is not complete as yet and is not considered in this assessment. Even when complete, it will not consider the coast at risk of flooding from the sea, erosion of the foreshore or inter-tidal areas or flooding as a consequence of erosion. However, we have conducted a review of areas along the coast of England and Wales using the outputs from the Defra Futurecoast project¹², produced for the Department for Environment, Food and Rural Affairs to assess the erosion / shoreline evolution. Where available, we have also reviewed the second generation Shoreline Management Plan documents to help determine shoreline evolution in areas where Futurecoast does not provide sufficient detail.</p> <p>For the purpose of this Study, we regard sites as <i>not worthy of further consideration</i> if coastal processes are likely to cause significant difficulties to the long term safety of a nuclear power station on the area or site in question and reasonable countermeasures are unlikely to be sufficient to remedy these difficulties.</p>
Proximity to hazardous facilities (D3)	<p>The Health and Safety Executive's methodology for assessing development near to hazardous installations is set out in the Planning Advice for Developments near Hazardous Installations (PADHI). This approach gives guidance to planning authorities in considering the suitability of domestic, institutional and industrial developments within a series of zones forming a Consultation Distance around hazardous installations.</p> <p>There is currently no national dataset showing hazardous facilities that is available to inform this Study. This information is held by local authorities and the Health and Safety Executive. We have therefore only considered this criterion for areas and sites that have not been ruled out as <i>not worthy of further consideration</i> through the application of national datasets or for other reasons.</p> <p>In coming to a view as to whether an area or site is <i>not worthy of further consideration</i>, the key factor has been whether, for a particular site or area, there are nearby hazardous facilities that may cause significant problems in meeting the PADHI guidance for the safety of a new nuclear power station.</p>

¹² Halcrow, 2002. Futurecoast [CD-ROM]

Criterion	Approach
Proximity to civil aircraft movements (D4)	<p>There is a risk to all nuclear facilities related to an aircraft crashing on or near to the site. Large aircraft crashes are a rare event in the UK. However the risk across the country is not uniform. Certain higher risk areas and zones are defined to protect infrastructure and human casualties from such an event. Examples include:</p> <ul style="list-style-type: none"> • Public Safety Zones; • Aerodrome Safeguarding Plans; and • Air Traffic Control Areas. <p>There is currently no national dataset showing proximity to civil aircraft movements that is available to inform this Study. Much of this information is held by local authorities and the Civil Aviation Authority. We have therefore only considered this criterion for areas and sites that have not been ruled out as <i>not worthy of further consideration</i> through the application of national datasets or for other reasons.</p> <p>Responsibility for aerodrome safeguarding rests, in all cases, with the aerodrome licensee / operator. In every case, the exact nature or scale of any impact upon aerodrome-related operations needs primarily to be established through consultation with the relevant aerodrome licensee / operator. However, this can only be done at the local level. Just as these issues are not being considered definitively as part of the assessment of nominations as part of the SSA process, we have not consulted individual aerodrome licensees / operators as part of this Study and we, therefore, cannot provide a definitive, aerodrome-specific safeguarding assessment.</p> <p>In coming to a view as to whether an area or site is <i>not worthy of further consideration</i>, a key factor has been whether there are nearby civil aircraft movements which may cause problems for a Nuclear Licensee in adhering to the Safety Assessment Principles (SAP) for Nuclear Facilities as set out by the NII. In addition, we have checked that the siting of a nuclear power station within an area or site is unlikely to cause major issues to civil aircraft movement in meeting the regulations set out in The Air Navigation (Restriction of Flying) (Nuclear Installations) Regulations 2007. Such sites were also reviewed by the CAA.</p>
Proximity to military activities (D5)	<p>In addition to the issues identified as exclusionary criteria, the Ministry of Defence is a statutory planning consultee and has powers to safeguard defence assets in order to protect the capability of defence organisations to carry out essential training and operations.</p> <p>The SSA process may reject nominated sites, on a discretionary basis, if they are in close proximity to, or would affect, MOD assets or activities.</p> <p>We developed, using data available in the public domain, a map of areas of other military activities which are not classed as exclusionary to the development of a nuclear power station but could still potentially rule out such development. Such areas include various tactical training areas, areas of intense activity and transit areas. The MOD were able to assist in sourcing this information.</p> <p>For the purpose of this Study, we regard sites as <i>not worthy of further consideration</i> if these non-exclusionary military activities are likely to cause significant difficulties to the development of a nuclear power station on the area or site in question and it is unlikely that reasonable steps can be taken to remedy these difficulties.</p> <p>The parts of the country covered by such military activities are shown in the map in Appendix D6.</p>

Criterion	Approach
<p>Internationally designated sites (D6)</p>	<p>In addition to the decision to exclude in Stage 1 of this screening exercise any area that is actually within an internationally designated site, we also need to consider effect (at a distance) as a result of development near to an internationally designated site.</p> <p>To help inform our judgement of the likely effect of the development of a new nuclear power station within an area or site that is close to (but not located within) an internationally designated site, we also developed a map showing buffer zones of 5 km, 10 km and 20 km from these designations. Adverse effects may be possible both within and beyond such a zone and development may still be possible within such a zone. However, this was a useful visual aid to the assessment of sites to help identify those <i>not worthy of further consideration</i>.</p> <p>We have judged each internationally designated site on its merits, including the nature and proximity of the designated site to the area or site in question. In coming to a view as to whether an area or site can be ruled out as <i>not worthy of further consideration</i>, a key factor has been where a significant effect on an internationally designated site is likely, taking into account reasonable mitigation measures. This is not a substitute for a full Habitats Regulations Assessment (HRA), but for an alternatives exercise it seems to us unreasonable to carry out HRAs on what would amount to hundreds of areas and sites. Rather, a more suitable approach taken in this Study is for competent technical experts to make assessments at a national, strategic level to rule out the areas and sites that are not likely to be feasible alternatives from the perspective of future assessments under Article 6 of the Habitats Directive.</p> <p>We note that some internationally designated sites are in close proximity to a major power station that has clearly been able to operate (or is operating) in tandem with the designation. Demonstrating that a new nuclear power station can operate without there being an adverse impact on the designation may prove challenging and cannot be confirmed without detailed assessment. However, in a strategic level study, we do not believe that we can rule out such an area or site as <i>not worthy of further consideration</i> on the basis of international designations when there is precedent set by a major existing power station operating alongside those designations. For example, any impacts or lack of them from the cooling water intake and outfall culverts are likely to be well characterised, meaning developments of a similar nature may also be able to operate without adverse impact. If the existing power station continues to operate alongside a proposed new nuclear power station, then any assessment would need to include the potential for cumulative impacts.</p>

Criterion	Approach
Nationally designated sites (D7)	<p>In line with the criterion described for internationally designated sites, the SSA process also uses the SSA assessment to help to minimise the negative effects of development on nationally designated sites of ecological sensitivity.</p> <p>These include:</p> <ul style="list-style-type: none"> • Sites of Special Scientific Interest; • National Nature Reserves; • Marine Nature Reserves; and • Limestone Pavement Orders. <p>Where national datasets were available, we developed a map of the nationally designated sites in England and Wales and used it to consider the potential for negative effects as a result of development near to or within these sites.</p> <p>Recognising the hierarchy and relationship between these sites and internationally designated sites, particularly in the context of any assessment under the Habitats Directive, we only came to a view that an area or site was <i>not worthy of further consideration</i> because of its proximity to nationally designated sites if the effect on the nationally designated site was so substantial (taking into account any reasonable mitigation measures) as to make the possibility of the development of a new nuclear power station on the site by the end of 2025 only a theoretical possibility. In coming to such a judgement, we took into account (as far as we are able to do at a national, strategic level) the particular characteristics and features of the area that make the effect so substantial.</p> <p>The map in Appendix D7 shows these nationally designated sites.</p>

Criterion	Approach
Areas of amenity, cultural heritage and landscape value (D8)	<p>The UK's planning system also seeks to protect, where possible, sites and structures of specific amenity, cultural heritage and landscape value.</p> <p>These include:</p> <ul style="list-style-type: none"> • Unesco World Heritage Sites; • Scheduled and ancient monuments (SAMs); • Protected wreck sites; • National Parks; • Areas of Outstanding Natural Beauty; and • Listed buildings. <p>Where national datasets were available, we developed a map of areas of amenity, cultural heritage and landscape value and used it to consider the potential for a large development to influence negatively the designated area as a result of development within these sites.</p> <p>Recognising the hierarchy and relationship between these sites and internationally designated sites, particularly in the context of any assessment under the Habitats Directive, we only came to a view that an area or site was <i>not worthy of further consideration</i> because of its location within an area of amenity, cultural heritage or landscape value if the negative influence of the development on the areas of amenity, cultural heritage and landscape value was likely (taking into account any reasonable mitigation measures and existing developments in the area) to make the possibility of the development of a new nuclear power station on the site by the end of 2025 only a theoretical possibility. In coming to such a judgement, we took into account (as far as we are able to do at a national, strategic level) the particular characteristics and features of the designated area that have led to the area being designated and whether the negative influence of any large development are likely to be substantial.</p> <p>The map in Appendix D8 shows these areas of amenity, cultural heritage and landscape value (note that certain amenity designations are not shown at a national level due to the large number of them (e.g. listed buildings, SAMs) but were considered as part of the Study).</p>

Criterion	Approach
Size of site to accommodate operations (D9)	<p>Stage 1 of our methodology has already ensured that only areas that have 1 km² or more of land suitable for 'defence in depth' are considered further within the Study. At least 0.3 km² of this must pass the demographics criterion (C1). A more detailed technical justification for the figures of 0.3 km² and 1 km² is set out in Appendix E3.</p> <p>However, this is not the only size-related factor that we need to consider in relation to areas and sites. For a site to be viable – both for ongoing operations and to be deployable by 2025 – at least 1 km² of land needs to be reasonably free from unsuitable topography and land use factors such as major roads, rivers, railway lines and other obstructions that cannot reasonably be moved. This is for non-radiological plant and ancillary facilities and with some regard for construction and decommissioning. An area or site that fails to meet this requirement is likely to be <i>not worthy of further consideration</i>.</p> <p>In addition, a site or area may also be regarded as <i>not worthy of further consideration</i> under this criterion if the size requirements set out above are met but there is a significant existing development (for example a town or a major road or railway line) between the site or area and the source of cooling water. This is because we think it unreasonable to site a new nuclear power station where it is inevitable that there will be significant disruption to existing developments and infrastructure. It may also call into question the deployability of the site by the end of 2025.</p> <p>Consideration of this criterion is not based on the application of national datasets. Rather, it requires the assessment of the available land, taking into account topographic, road, rail and other land-use issues and proximity to the likely suitable source of cooling water. We have therefore only considered this criterion for areas and sites that have not been ruled out as <i>not worthy of further consideration</i> through the application of national datasets or for other reasons.</p>
Access to suitable sources of cooling (D10)	<p>As part of Stage 1 of our methodology, we have ruled out sites and areas that are more than 2 km away from a significant body of water. However, the definition of "coast" adopted by the OS baseline map we used includes rivers up to the normal tidal limit. Many of these rivers, although tidal, will not have flow rates we regard as necessary even for indirect cooling.</p> <p>We therefore rule out areas or sites as <i>not worthy of further consideration</i> if, on examining the area or site further at a local level, there is insufficient water to support even indirect cooling of a modern nuclear power station.</p> <p>We would also rule out a site as <i>not worthy of further consideration</i> if, on examining coastal areas or sites further at a local level, the cliffs are sufficiently high (typically > 30 m) or deep water is too great a distance offshore (typically > 5 km) as to make the use of direct cooling from the sea unreasonable and where indirect cooling is inappropriate for reasons of good engineering practice (including visual impact).</p>

Results

- 4.9 Table 4.2 shows the result of our analysis of the 270 areas that pass Stage 1 of our screening methodology. (The nine sites at the end of the table are those that did not pass Stage 1 automatically as they are less than 1 km² in size; however, as set out in Table E3.1 in Appendix E3, they nevertheless have sufficient land for 'defence-in-depth' and pass through to Stage 2 on this basis.). Appendices G1 to G6 show the 261 areas that passed Stage 1 automatically. Appendix G7 shows the 80 sites with areas between 0.3 km² and 1 km², including the nine areas that pass through to Stage 2 from this group.
- 4.10 As set out in paragraph 2.9 we are content that the nominations process is superior, in terms of considering the best site to nominate within a particular part of the country, to any consideration we can bring from the perspective of a national level, strategic study. Some of the areas which passed the screening that contain nominated sites are small and, in such cases, there is no need for us to consider whether there are other possible locations within that area given that we are satisfied that the nominations process has identified the best site at a local level. In other cases, the areas that contain nominated sites are large and it seems unreasonable to rule out the entire area as *not worthy of further consideration* because a site has been nominated many kilometres away. We are not prescriptive in terms of how far from a nominated site we should go before we start considering the merits of alternative sites within the area. This will depend on a number of factors, including the extent to which it is clear that energy companies have considered the area beyond the nominated site. Provided energy companies' considerations remain superior to our own, we do not consider parts of an area away from a nominated site for the purposes of this Study. This approach is reflected in Table 4.2.

Table 4.2: Results of Stage 2 methodology to determine whether each of the 270 areas can reasonably be regarded as worthy of further consideration or not worthy of further consideration

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
1	30.7	G1 – North North of Carlisle	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
2	105.5	G1 – North West of Carlisle to Maryport	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and areas of amenity.
3	7.0	G1 – North North of Workington	<i>Not worthy of further consideration</i>	Size of site (topography and land use).
4	8.6	G1 – North North of Whitehaven	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (cliff height) and size of site (topography).
5	96.2	G1 – North South of Whitehaven and West of Millom	This Area contains three nominated sites (at Sellafield, Braystones and Kirksanton) and was not considered for the purposes of this Study.	
6	33.4	G1 – North North of Millom and to the North of Askam in Furness	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
7	6.8	G1 – North North of Barrow	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
8	3.0	G1 – North South of Barrow-in-Furness	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
9	105.5	G1 – North East of Barrow-in-Furness to North of Carnforth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
10	1.0	G1 – North Area near Greenodd	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
11	2.1	G1 – North North of Carnforth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
12	1.2	G1 – North South of Carnforth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
13	1.5	G1 – North North East of Lancaster	<i>Not worthy of further consideration</i>	Size of site (land use).
14	12.4	G1 – North South of Heysham	This Area contains a nominated site (at Heysham) and was not considered for the purposes of this Study.	
15	37.6	G1 – North East of Fleetwood and South of Lancaster	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
16	33.6	G1 – North South of Fleetwood and East of Blackpool	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
17	5.7	G1 – North South of Formby	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
18	2.2	G3 – Wales South of Warrington	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (periods of low fluvial flow) and size of site (land use).
19	7.1	G3 – Wales East of Widnes	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (periods of low fluvial flow).
20	1.2	G3 – Wales West of Runcorn	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
21	2.1	G3 – Wales East of Speke	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
22	13.8	G3 – Wales East of Ellesmere Port and South of Runcorn	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
23	2.6	G3 – Wales West of Ellesmere Port	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
24	3.8	G3 – Wales West of Birkenhead	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
25	2.2	G3 – Wales South of Heswall and North of Neston	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
26	9.8	G3 – Wales North of Connah's Quay	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, access to suitable sources of cooling and size of site (land use).
27	2.7	G3 – Wales East of Flint	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
28	1.0	G3 – Wales West of Flint	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
29	2.9	G3 – Wales East of Holywell	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
30	21.2	G3 – Wales North West of Holywell	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
31	3.3	G3 – Wales South of Rhyl and West of Rhuddlan	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (periods of low fluvial flow).
32	1.6	G3 – Wales East of Abergele and West of Rhuddlan	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (egress) and size of site (land use).
33	8.0	G3 – Wales Abergele	<i>Not worthy of further consideration</i>	Size of site (topography and land use).
34	41.0	G3 – Wales South of Llandudno and East of Llanfairfechan	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and size of site (topography).
35	15.9	G3 – Wales East of Bangor and West of Llanfairfechan	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
36	111.7	G3 – Wales East of Amlwch and to the North of Caernarfon	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and size of site (topography).
37	46.6	G3 – Wales North of Holyhead and to the West of Amlwch	This area contains a nominated site (at Wylfa) and part of the area was not considered for the purposes of this Study. The remainder of the area was <i>not worthy of further consideration</i> because of proximity to military activities and size of site (topography).	

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
38	4.3	G3 – Wales West of Caernarfon	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
39	17.2	G3 – Wales East of Caernarfon and West of Bangor	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
40	5.9	G3 – Wales South of Caernarfon	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
41	294.0	G3 – Wales South of Llanfaglan and North of Dolgellau	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
42	58.2	G3 – Wales West of Dolgellau and North of Tywyn	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities .
43	58.7	G3 – Wales South of Tywyn to North of Aberystwyth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
44	124.7	G3 – Wales South of Aberystwyth to the South of Cardigan	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
45	241.4	G3 – Wales South of Cardigan to North of Milford Haven	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (cliff height).
46	39.4	G3 – Wales East of Milford Haven to South of Haverfordwest	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
47	24.7	G3 – Wales South of Haverfordwest to West of Narberth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
48	58.8	G3 – Wales East of Pembroke	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
49	49.2	G3 – Wales South of Pembroke to St Govans Head	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and proximity to hazardous facilities.
50	33.4	G3 – Wales St Govans Head to Tenby	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
51	1.8	G3 – Wales Caldey Island	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
52	4.9	G3 – Wales North of Temby and South of Pentlepoir	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
53	45.6	G3 – Wales South of St Clears and North east of Saundersfoot	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
54	34.8	G3 – Wales South of Carmarthen to South of St Clears	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
55	51.6	G3 – Wales South of Carmarthen and West of Llanelli	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
56	5.2	G3 – Wales East of Burry Port and West of Llanelli	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
57	2.6	G3 – Wales East of Llanelli and West of Pontarddulais	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
58	3.4	G3 – Wales East of Llangennech and South of Pontarddulais	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
59	2.7	G3 – Wales East of Llwynhendy and West of Loughor	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
60	66.0	G3 – Wales West of Gorseinon and East of The Mumbles	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, access to suitable sources of cooling (cliff height) and size of site (topography).
61	8.0	G3 – Wales East of Swansea and North of Port Talbot	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
62	1.1	G3 – Wales North of Port Talbot	<i>Not worthy of further consideration</i>	Size of site (land use).
63	10.1	G3 – Wales West of Margam	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to hazardous facilities and size of site (land use).
64	2.9	G3 – Wales North of Porthcawl	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.

Area Number	Area Size (km²)	Map Location	Atkins' view	Rationale
65	32.7	G3 – Wales East of Portcawl to Llantwit Major	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (cliff height).
66	18.0	G3 – Wales West of Barry to East of Llantwit Major	<i>Not worthy of further consideration</i>	Proximity to military activities and proximity to civil aircraft activities (implementation of an air exclusion area around a new nuclear power station would inhibit air traffic access to Cardiff International Airport).
67	2.6	G3 – Wales South of Penarth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to civil aircraft activities (the airspace in this region is particularly complex and restrictive).
68	13.9	G3 – Wales East of Cardiff and South of Newport	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
69	28.7	G3 – Wales South of Newport and West of Caldicott	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
70	8.2	G5 – South Central East of Caldicott and South West of Chepstow	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
71	4.8	G5 – South Central North of Chepstow and South of Chapel Hill	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
72	26.1	G5 – South Central East of Chepstow and West of Lydney	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
73	316.5	G5 – South Central North of Bristol to South of Tewkesbury	This area contains a nominated site (at Oldbury) and part of the area was not considered for the purposes of this Study. The remainder of the area was <i>not worthy of further consideration</i> because of potential adverse impact to internationally designated sites, access to suitable sources of cooling and potential adverse impact to areas of amenity, cultural heritage and landscape value.	
74	5.7	G5 – South Central East of Portishead	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
75	5.5	G5 – South Central South of Portishead	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
76	16.3	G5 – South Central North of Weston-super-Mare	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
77	16.1	G5 – South Central South of Weston-super-Mare	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
78	18.4	G5 – South Central South of Highbridge	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
79	53.6	G4 – South West West of Minehead to East of Watchet	This area contains a nominated site (at Hinkley Point) and part of the area was not considered for the purposes of this Study. The remainder of the area was <i>not worthy of further consideration</i> because of potential adverse impact to internationally designated sites and size of site (topography) and access to suitable sources of cooling (cliff height).	
80	18.3	G4 – South West East of Minehead to West of Watchet	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (cliff height) and size of site (land use).
81	3.7	G4 – South West West of Minehead	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
82	45.8	G4 – South West East of Trentishoe to West of Selworthy	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (cliff height).
83	19.5	G4 – South West East of Ilfracombe	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (cliff height).
84	34.6	G4 – South West West of Ilfracombe to West of Chivenor	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites proximity to military activities and access to suitable sources of cooling (cliff height).
85	12.1	G4 – South West West of Barnstaple	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities, access to suitable sources of cooling water (cliff height) and size of site (land use).
86	37.1	G4 – South West West of Barnstaple to South of Northam	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and access to suitable sources of cooling (periods of low fluvial flow).

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
87	1.6	G4 – South West North of Westward Ho!	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
88	30.1	G4 – South West West of Bideford to Clovelly	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and access to suitable sources of cooling (cliff height).
89	27.8	G4 – South West West of Clovelly to North of Gooseham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
90	4.6	G4 – South West Lundy	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
91	19.2	G4 – South West Area to the North of Bude to South of Gooseham	<i>Not worthy of further consideration</i>	Potential adverse impact to Internationally designated sites and access to suitable sources of cooling (cliff height).
92	107.5	G4 – South West South of Bude to North of Wadebridge	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, access to suitable sources of cooling (cliff height) and size of site (topography).
93	34.9	G4 – South West West of Wadebridge to Porthcothan	<i>Not worthy of further consideration</i>	Potential adverse impact to areas of amenity and access to suitable sources of cooling (cliff height).
94	4.5	G4 – South West West of Newquay	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and access to suitable sources of cooling (cliff height).
95	52.1	G4 – South West North of Hayle to the South of Holywell	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
96	1.8	G4 – South West South of Hayle	<i>Not worthy of further consideration</i>	Proximity to military activities.
97	8.0	G4 – South West South of St Ives	<i>Not worthy of further consideration</i>	Proximity to military activities.
98	81.6	G4 – South West West of St Ives and to the South of Penzance	<i>Not worthy of further consideration</i>	Proximity to military activities.
99	20.5	G4 – South West East of Penzance	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
100	14.4	G4 – South West North of St Keverne	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
101	16.6	G4 – South West South of Falmouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
102	41.9	G4 – South West North of Falmouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
103	115.7	G4 – South West East of Truro and to the South of St Austell	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and access to suitable sources of cooling (cliff height).
104	194.3	G4 – South West East of St Austell and to the West of Plymouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (cliff height).
105	23.8	G4 – South West North of Plymouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
106	127.7	G4 – South West South of Plymouth to the South of Kingsbridge	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military areas and access to suitable sources of cooling (cliff height).
107	70.4	G4 – South West East of Kingsbridge to the North of Stoke Fleming	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (cliff height).
108	29.0	G4 – South West North of Dartmouth to South of Totnes	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (cliff height and periods of low fluvial flow).
109	37.3	G4 – South West South of Totnes to South of Brixham	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (cliff height and periods of low fluvial flow).
110	11.8	G4 – South West North of Torquay	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling water (cliff height) and size of site (topography).
111	4.7	G4 – South West West of Teignmouth	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling water (cliff height) and size of site (topography).
112	14.3	G4 – South West North of Dawlish	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
113	12.5	G4 – South West North of Exmouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
114	5.2	G4 – South West East of Exmouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and access to suitable sources of cooling (cliff height).
115	19.1	G4 – South West South West of Sidmouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (cliff height).
116	15.1	G5 – South Central East of Sidmouth to West of Seaton	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
117	20.1	G5 – South Central West of Lyme Regis	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
118	61.1	G5 – South Central East of Lyme Regis to West of Weymouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
119	55.8	G5 – South Central West of Swanage to East of Weymouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
120	5.2	G5 – South Central North of Swanage	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
121	11.3	G5 – South Central North of Corfe Castle	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
122	2.4	G5 – South Central East of Wareham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
123	6.0	G5 - South Central South of Wareham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
124	9.0	G5 – South Central South of Lymington and East of Christchurch	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and potential for coastal erosion over the next 100 years.
125	2.0	G5 – South Central West of Freshwater	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
126	2.2	G5 – South Central Norton (Isle of Wight)	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
127	87.3	South Central West of Cowes and to the North of Ventnor	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
128	6.1	G5 – South Central North of Sandown	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
129	6.0	G5 – South Central South of Ryde	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
130	19.6	G5 – South Central North of Newport (Isle of Wight)	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
131	3.9	G5 – South Central North of Newport (Isle of Wight)	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
132	53.9	G5 – South Central East of Lymington to South of Hythe	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
133	1.1	G5 – South Central South of Southampton	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
134	4.9	G5 – South Central South West of Fareham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
135	9.9	G5 – South Central North of Fareham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
136	5.1	G5 – South Central East of Portsmouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
137	4.2	G5 – South Central South of Southbourne	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
138	20.2	G5 – South Central West of Chichester	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
139	39.5	G5 – South Central South of Chichester	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and flood risk.
140	1.7	G5 – South Central West of Bognor Regis	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
141	12.6	G6 – South East East of Bognor Regis	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (distance to deep water).
142	4.3	G6 – South East North of Shoreham-by-Sea	<i>Not worthy of further consideration</i>	Size of site (topography).
143	1.4	G6 – South East East of Newhaven	<i>Not worthy of further consideration</i>	Size of site (topography).
144	1.6	G6 – South East East of Seaford	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (cliff height) and size of site (topography).

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
145	37.9	G6 – South East West of Eastbourne	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (cliff height and periods of low fluvial flow).
146	1.5	G6 – South East West of Bexhill	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
147	14.9	G6 – South East North East of Hastings	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (cliff height).
148	26.9	G6 – South East West of Lydd to North East of Rye	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, flood risk and access to suitable sources of cooling (periods of low fluvial flow).
149	3.1	G6 – South East East of Lydd	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
150	17.8	G6 – South East South of Hythe to North of Littlestone-on-Sea	<i>Not worthy of further consideration</i>	Flood risk, proximity to military activities and size of site (land use).
151	1.1	G6 – South East North of Hythe	<i>Not worthy of further consideration</i>	Size of site (topography).
152	10.6	G6 – South East East of Folkestone	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (cliff height).
153	14.6	G6 – South East South of Deal	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
154	1.2	G6 – South East North of Sholden	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
155	2.4	G6 – South East North of Deal	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
156	2.8	G6 – South East South of Sandwich	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
157	2.5	G6 – South East North of Sandwich	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
158	1.5	G6 – South East North West of Sandwich	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (periods of low fluvial flow).
159	36.2	G6 – South East West of Sandwich to East of Canterbury	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (periods of low fluvial flow).

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
160	35.5	G6 – South East West of Cliffs End to Hersden	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (periods of low fluvial flow).
161	14.2	G6 – South East East of Herne Bay	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
162	1.4	G6 – South East South of Whitstable	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
163	23.9	G6 – South East East of Minster (Isle of Sheppey)	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, access to suitable sources of cooling (cliff height) and size of site (land use).
164	6.0	G6 – South East South of Isle of Sheppey	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
165	8.2	G6 – South East East of Faversham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
166	3.5	G6 – South East North West of Faversham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
167	8.7	G6 – South East East of Sittingbourne	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
168	1.0	G6 – South East Elmley Island	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
169	14.3	G6 – South East East of Gillingham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
170	1.2	G6 – South East West of Isle of Sheppey	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
171	1.5	G6 – South East South of Queenborough	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
172	8.1	G6 – South East Isle of Grain	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to hazardous facilities.
173	24.5	G6 – South East East of St Mary Hoo to East of Hoo St Werburgh	Part of the area is <i>worthy of further consideration</i>	The majority of the area is <i>not worthy of further consideration</i> due to potential adverse impact to internationally designated sites. However, the area to the north and west of the existing power station at Kingsnorth is <i>worthy of further consideration</i> . See Appendix H for more detailed assessment.

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
174	3.8	G6 – South East North of Cooling	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
175	3.5	G6 – South East East of Gravesend	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
176	12.1	G6 – South East North of Maidstone	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (periods of low fluvial flow).
177	6.9	G6 – South East North of Snodland	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (periods of low fluvial flow).
178	4.8	G6 – South East East of Tilbury	<i>Not worthy of further consideration</i>	Eastern part of the area is <i>not worthy of further consideration</i> due to potential adverse impact to internationally designated sites. However, the area to the east and north of the existing power station cannot be ruled out on this basis. However, on the basis of the size and distribution of the surrounding population, this area is <i>not worthy of further consideration</i> because of difficulties in extendibility planning so close to London and other nearby conurbations.
179	1.0	G6 – South East South of Stanford-le-Hope	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
180	12.0	G6 – South East West of Canvey Island	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and flood risk.
181	2.4	G6 – South East Canvey Island	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and flood risk.
182	4.6	G6 – South East North of Canvey Island and South of Bowers Gifford	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and flood risk.
183	5.8	G6 – South East East of Runwell	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
184	32.9	G6 – South East East of Rochford to East of Hullbridge	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
185	8.5	G6 – South East North of Southend-on-Sea	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
186	2.0	G6 – South East East of Great Wakering	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
187	3.1	G6 – South East Potton Island	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
188	20.5	G6 – South East Foulness Island	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
189	9.6	G6 – South East South of Burnham-on-Crouch	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
190	22.4	G6 – South East West of Burnham-on-Crouch to East of South Woodham Ferrers	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
191	59.0	G6 – South East East of Maylandsea to East of Burnham-on-Crouch	This area contains a nominated site (at Bradwell) and part of the area was not considered for the purposes of this Study. The remainder of the area was <i>not worthy of further consideration</i> because of potential adverse impact to internationally designated sites.	
192	14.1	G6 – South East South East of Maldon	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
193	7.2	G6 – South East East of Chelmsford	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (periods of low fluvial flow).
194	61.0	G6 – South East West of Wivenhoe to East of Heybridge	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
195	10.7	G6 – South East Mersea Island	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
196	2.3	G6 – South East West of Brightlingsea	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
197	32.6	G6 – South East West of Clacton-on-Sea and South of Wivenhoe	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
198	5.1	G6 – South East South of Frinton-on-Sea	<i>Not worthy of further consideration</i>	Potential adverse impact to nationally designated sites and size of site (land use).
199	25.2	G6 – South East South of Harwich and West of Frinton-on-Sea	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
200	2.2	G6 – South East North of Walton-on-the-Naze	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
201	21.1	G6 – South East West of Harwich to East of Manningtree	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
202	1.1	G6 – South East West of Manningtree	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
203	2.8	G6 – South East North of Manningtree	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
204	48.5	G6 – South East South of Ipswich to East of Brantham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
205	21.3	G6 – South East South of Felixstowe to South East of Ipswich	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
206	29.7	G6 – South East North of Felixstowe to South West of Woodbridge	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
207	134.6	G6 – South East North of Sizewell to North of Woodbridge	This area contains a nominated site (at Sizewell) and part of the area was not considered for the purposes of this Study. The remainder of the area was <i>not worthy of further consideration</i> because of potential adverse impact to internationally designated sites, size of site (land use) and access to suitable sources of cooling (low fluvial flow).	
208	6.5	G6 – South East West of Dunwich	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
209	32.1	G6 – South East West of Southwold	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (periods of low fluvial flow).
210	2.6	G6 – South East West of Walberswick	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
211	7.6	G6 – South East North of Southwold	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
212	4.3	G6 – South East South of Kessingland	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
213	2.1	G6 – South East South of Lowestoft and North of Kessingland	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
214	13.4	G6 – South East East of Beccles	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (periods of low fluvial flow).

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
215	118.9	G6 – South East South of Norwich and to the West of Beccles	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (periods of low fluvial flow).
216	7.5	G6 – South East East of Norwich	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and access to suitable sources of cooling (periods of low fluvial flow).
217	21.6	G6 – South East West of Lowestoft to South of Belton	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (periods of low fluvial flow).
218	6.1	G6 – South East East of Reedham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
219	21.3	G6 – South East South of Brundall	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
220	7.0	G6 – South East North of Lowestoft	<i>Not worthy of further consideration</i>	Potential for coastal erosion over the next 100 years.
221	4.3	G6 – South East West of Great Yarmouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
222	11.0	G6 – South East North West of Great Yarmouth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
223	4.4	G6 – South East North of Caister-on-Sea	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
224	65.5	G2 – North East East of Cromer to North of Hemsby	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and potential for coastal erosion over the next 100 years.
225	6.3	G2 – North East East of Sheringham	<i>Not worthy of further consideration</i>	Size of site (topography and land use).
226	24.3	G2 – North East East of Stiffkey and West of Sheringham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
227	50.1	G2 – North East South of Hunstanton to East of Wells-next-the-Sea	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
228	32.5	G2 – North East South of Heacham and North of King's Lynn	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.

Area Number	Area Size (km²)	Map Location	Atkins' view	Rationale
229	48.8	G2 – North East South of Sutton Bridge and South of King's Lynn	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
230	70.4	G2 – North East South of Boston and North of Sutton Bridge	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
231	57.3	G2 – North East East of Boston and South of Skegness	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
232	28.6	G2 – North East South of Mablethorpe and North of Skegness	<i>Not worthy of further consideration</i>	Flood risk and potential adverse impact to internationally designated sites.
233	43.6	G2 – North East South of Cleethorpes to North of Mablethorpe	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
234	11.1	G2 – North East North of Grimsby and East of Immingham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
235	33.8	G2 – North East East of Barton-upon-Humber and North of Immingham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to hazardous facilities and size of site (land use).
236	96.6	G2 – North East North of Gainsborough to West of Barton-upon-Humber	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, civil aircraft activities, flood risk (Sequential Test) and size of site (land use).
237	332.7	G2 – North East East of Nottingham to South of Goole	Part of the area is <i>worthy of further consideration</i>	<p>The majority of the area is <i>not worthy of further consideration</i> due to potential adverse impact to internationally designated sites, proximity to civil aircraft activities, proximity to military activities, flood risk (Sequential Test) and size of site (topography and land use).</p> <p>However, there is an area near Owston Ferry that is <i>worthy of further consideration</i>. See Appendix H for more detailed assessment.</p>

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
238	2.7	G2 – North East East of Nottingham	<i>Not worthy of further consideration</i>	Size of site (land use) and proximity to military activities.
239	20.8	G2 – North East North of Castle Donnington and West of Ruddington	<i>Not worthy of further consideration</i>	Civil aviation activity and size of site (topography and land use).
240	72.5	G2 – North East South East of Selby and West of Brough	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
241	4.3	G2 – North East North Ferriby	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
242	3.1	G2 – North East East of North Ferriby	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
243	42.9	G2 – North East East of Kingston upon Hull and West of Skeffing	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and size of site (land use).
244	77.8	G2 – North East South of Hornsea and North of Spurn Head	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to military activities and potential for coastal erosion over the next 100 years.
245	34.0	G2 – North East South of Bridlington and North of Hornsea	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
246	38.3	G2 – North East South of Filey and North of Bridlington	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
247	8.8	G2 – North East South of Scarborough	<i>Not worthy of further consideration</i>	Proximity to military activities.
248	51.4	G2 – North East South of Whitby to the North of Scarborough	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
249	37.4	G2 – North East East of Loftus to the West of Whitby	<i>Not worthy of further consideration</i>	Proximity to military activities.
250	3.1	G2 – North East East of Saltburn-by-the-Sea	<i>Not worthy of further consideration</i>	Proximity to military activities.
251	26.8	G2 – North East South West of Ingleby Barwick	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (periods of low fluvial flow).

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
252	13.6	G2 – North East North of Middlesbrough	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
253	24.4	G2 – North East South of Hartlepool	This area contains a nominated site (at Hartlepool) and was not considered for the purposes of this Study.	
254	3.0	G2 – North East South East of Peterlee	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
255	4.2	G2 – North East South of Seaham	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
256	7.8	G1 – North West of Newcastle upon Tyne	<i>Not worthy of further consideration</i>	Access to suitable sources of cooling (periods of low fluvial flow).
257	5.8	G1 – North South of Blyth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites, proximity to civil aircraft activities and size of site (land use).
258	2.9	G1 – North North of Blyth	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to civil aircraft activities.
259	155.2	G1 – North South of Berwick-upon-Tweed and to the North of Newbiggin-by-the-Sea	Part of the area is <i>worthy of further consideration</i>	The majority of the area is <i>not worthy of further consideration</i> due to adverse impact on internationally designated sites and size of site (land use). However, at Druridge Bay and the surrounding area there is a site <i>worthy of further consideration</i> . See Appendix H for more detailed assessment.
260	1.9	G1 – North Holy Island	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
261	17.2	G1 – North North of Berwick-upon-Tweed	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
S02	0.8	G7 – England and Wales West of Barrow-in-Furness	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
S13	0.9	G7 – England and Wales South of Pembroke	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites and proximity to military activities.
S39	1.0	G7 – England and Wales North of Hythe	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
S42	0.8	G7 – England and Wales East of Hedge End	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.

Area Number	Area Size (km²)	Map Location	Atkins' view	Rationale
S59	0.4	G7 – England and Wales West of St Mary Hoo	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
S60	0.9	G7 – England and Wales South of Stanford-le-Hope	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
S65	0.5	G7 – England and Wales North of Maylandsea	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
S67	0.7	G7 – England and Wales East of Brightlingsea	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.
S68	0.4	G7 – England and Wales West of Walton-on-the-Naze	<i>Not worthy of further consideration</i>	Potential adverse impact to internationally designated sites.

4.11 It is reasonable to conclude that all but three of the areas may be regarded as *not worthy of further consideration* – that is, in all but three cases we believe that there is a reason to suggest that, the site would fail to meet the SSA Criteria (including deployability by 2025).

4.12 The exceptions – that is, the three areas or sites we cannot rule out as *not worthy of further consideration* – are:

- Part of Area 259 around Druridge Bay in Northumberland;
- Part of Area 237 north west and south west of Owston Ferry in Lincolnshire; and
- Part of Area 173 north and west of the existing Kingsnorth Power Station in Kent.

4.13 A detailed map of each of the three areas or sites together with a more detailed technical commentary that supports our judgement on each is set out in Appendix H. The main issues connected with each area or site are set out below.

Druridge Bay and surrounding area

4.14 The Druridge Bay area identified in our screening process is adjacent to a nationally designated area of ecological importance along the shoreline, the impact to which we believe could be mitigated by siting the station a little way back from the coast itself and running the cooling water culverts underneath the shoreline. We note, however, that Druridge Bay is part of the Northumberland Heritage Coast (although not part of the AONB) and part of the land is owned by the National Trust. We note there is no Grid connection in close proximity, with the nearest transmission lines in excess of 10 km away.

Kingsnorth

- 4.15 As part of our Stage 2 methodology, we considered sites close to existing conventional power stations (including conventional stations that are near to internationally designated sites). In all cases, with the exception of Kingsnorth in Kent, we found reasons to rule these out as *not worthy of further consideration*. The Medway Estuary & Marshes SPA / Ramsar site surrounds the site at Kingsnorth on three sides, and demonstrating that a new nuclear power station can operate without there being an adverse impact on these international designations may prove challenging, given the cumulative effect of additional cooling water if the existing conventional station remains operational. However, the precedent set by the conventional station (which has been able to exist in tandem with the internationally designated sites including from the perspective of cooling water extraction and discharge) means that it may be easier to make the case that a new nuclear power station within this location may be developed without adverse impact.
- 4.16 In addition, we have some reservations about Kingsnorth from a demographic perspective. While it is the case that, according to our calculations, it would pass the Semi-Urban demographic criterion, there are nevertheless likely to be some problems with the development of a site so close to a conurbation the size of Greater London and the Medway Towns. Problems include difficulties in securing a nuclear site licence and in meeting the requirements for emergency planning. While these are matters for the regulators and local emergency planning authorities to consider at a later stage in the planning process, it may be that, given these factors, Kingsnorth is significantly more challenging to develop as a nuclear power station than a conventional power station. In addition, we note the current application for Section 36 consent for a new CCGT station at Damhead Creek. For the purposes of this Study, we have not assumed that consent will be granted – but, should it be, it would be far from straightforward, from a logistical perspective, to develop a new nuclear power station alongside new conventional power stations. Furthermore, we understand that the existing Kingsnorth Power Station is scheduled to cease operations around 2015 and any decommissioning plans could also complicate the development of a new nuclear power station on a nearby site.
- ### Owston Ferry and the lower Trent Valley
- 4.17 The requirement for an area or site to be within 2 km of a significant body of water is met through the use of indirect cooling (cooling towers) by river-based sites with a fluvial flow rate of more than $20 \text{ m}^3\text{s}^{-1}$ at least 95% of the time (Q95). This rules out all rivers with the exception of part of the Trent (recognising that stretches at the lower end of what may be regarded as rivers may be tidal and may be covered by our screening exercise on the basis that they are coastal (or estuarine)). Much of the Trent can be ruled out because of civil aviation risk (including proximity to several military training zones and proximity to East Midlands Airport) and, upstream of Nottingham, because of the risk of inundation should dams further upstream be breached. There is also a small stretch close to the Humber Estuary SAC, SPA, Ramsar site that can be ruled out on the grounds of proximity to international designations (D6) (approximately north of the M180 motorway) and an area between Nottingham and Gunthorpe that for topographic and land-use reasons we believe can be ruled out on size of site grounds (D9). This leaves an area between Gainsborough and the M180 motorway that we then considered further.

- 4.18 In applying the flood risk criterion (D1) to this alternatives exercise, we need to consider whether sites and areas would be likely to pass the Sequential Test and, in particular, whether there are likely to be reasonably available sites at a lower flood risk appropriate to the type of development proposed, that would need to be developed first. As a consequence, parts of the Lower Trent at higher flood risk may be undevelopable (by 2025 or otherwise) as the sequential approach inherent in PPS25 would guide any development towards the lower flood risk areas. The lower flood risk areas that are not ruled out for other reasons are a Flood Risk 1 and Flood Risk 2 area near Owston Ferry (Area 237) and a Flood Risk 2 area between East Butterfield and Messingham (Area 236), although the latter is unattractive not only because it is at higher flood risk than parts of the area at Owston Ferry but also because there are four gas pipelines crossing through the South East corner of the Flood Risk 2 area. We therefore suggest, noting the drawbacks of river-based sites in paragraph 4.19 below, that PPS25 would guide any development towards the lower flood risk areas at Owston Ferry and that the remainder of this stretch of the River Trent can be regarded as *not worthy of further consideration*.
- 4.19 Although river-based sites are technically feasible for nuclear stations (and do operate successfully and safely worldwide), there are a number of drawbacks associated with them:
- There are few precedents for the development of river-based nuclear power stations in the UK (which would require indirect cooling using cooling towers), so the development of safety cases and other consents documentation could be more difficult and time-consuming. We note that Chapel Cross Nuclear Station did receive cooling water from the River Annan, though the size of the station (~240 MW) is much smaller than modern nuclear reactors.
 - Although some river-based sites pass the flow rate test we applied (a rate of more than $20 \text{ m}^3\text{s}^{-1}$ at least 95% of the time (Q95)), flow rates may still, especially over the operating life of the station, lead to periods where the station would need to shut down because of a lack of sufficient water. We note the need in 2003 during the heatwave to grant three river-based plants in France special exemptions from rules limiting the top temperature of cooling water discharged into rivers to 24°C . Bugey on the Rhône, Tricastin on the Drôme and Golfech on the Garonne were allowed temporarily to discharge water at 30°C (and subsequently exceeded this level). Such issues did not arise with coastal stations because of the availability of very substantially greater volumes of water and the much more effective use of the sea as a heat sink.
 - There has been a trend in recent years in the UK, based not least on the grounds of public pressure and concern, for the nuclear industry to close pipelines that require radioactive discharges into rivers. River-based siting for a new generation of nuclear power stations would run contrary to this trend.
- 4.20 The use of cooling towers is usually associated with a loss in efficiency of the power station, involving a substantial reduction in revenue. Coastal or estuarine locations will therefore be significantly more attractive to energy companies for new nuclear build. We note that all 11 sites nominated as part of the SSA process are coastal or estuarine locations and in our discussions with energy companies about river-based sites, some ruled out their development completely and even the most positive regarded them as a low priority (although not totally ruled out in the longer term).

- 4.21 While these arguments are not sufficient from a technical perspective to rule out river-based sites as *not worthy of further consideration*, we can see no reason why Owston Ferry would not meet the SSA Criteria, we nevertheless believe that there are significant issues that apply to river-based sites that do not similarly apply to coastal locations. It may be that given these factors and in the absence of a strong case from an energy company explaining how these issues could be overcome, Owston Ferry is not a realistic contender for development by 2025.

Early deployability

- 4.23 Paragraph 1.4 sets out the importance that the Government attaches to early deployability and paragraph 2.19 notes that energy companies have no interest in developing a new nuclear power station at Druridge Bay, Kingsnorth and Owston Ferry and, although they considered and rejected the idea of nominating the first two of these, it was on the basis of strategic, rather than site-specific detailed information. Therefore it seems clear that no site analysis or preparation work has been done – in contrast to many or all of the nominated sites – and that it is therefore reasonable to conclude that it would take considerably longer to develop these sites than most of the nominated sites. In addition, there are certain site-specific factors that may make early deployment at Druridge Bay, Kingsnorth and Owston Ferry more problematic than at many of the nominated sites:
- For Druridge Bay, distance and complexity of connection to the National Grid and the design of a long cooling water outfall to avoid any heat plume impacting the sensitive shoreline;
 - For Owston Ferry, the novel nature of developing a river-based site in terms of licensing and logistics and the need to study how the cooling water discharge could be designed to avoid affecting the ecology and fish migration patterns; and
 - For Kingsnorth, the difficulties of developing a new nuclear power station adjacent to an operating power station that is likely to cease generating in 2015 and where there are applications for Section 36 consents pending.

- 4.24 Overall, we judge that the impact on deployment (and therefore delay) could be significant.

Other sites

- 4.25 Beyond these three alternative sites, we believe that it would be reasonable to conclude that, on the basis of current information and technology, there are no other areas or sites *worthy of further consideration* for the purposes of the Nuclear NPS.

5. Conclusions

5.1 Overall our conclusions are that the following sites are *worthy of further consideration* for deployment by the end of 2025:

- **Druridge Bay**, noting that our screening process identified that there is a nationally designated area of ecological importance along the shoreline, the impact to which, we believe, could be mitigated by siting the station a little way back from the coast itself and running the cooling water culverts underneath the shoreline. We note, however, that Druridge Bay is part of the Northumberland Heritage Coast and part of the land is owned by the National Trust. We note there is no Grid connection in close proximity, with the nearest transmission lines in excess of 10 km away.
- **Owston Ferry**, noting that we strongly believe there are drawbacks inherent in river-based sites that may make them unattractive from the perspective of development. For example, the use of river water for cooling may lead to reduced thermal efficiency that (while we have explicitly excluded economic factors from our Study) could result in lower power generation and thus a significant loss in revenue, and there may be a susceptibility to reduced operations during drought. There is also an absence of any recent precedent for river-based nuclear power stations in the UK. Furthermore, while significantly less of an issue than upstream on the Trent, siting a new nuclear power station on the Lower Trent would be likely to be problematic to the light aviation (and military aviation) community. It may be that, given these factors, river-based sites are not realistic contenders for development by 2025. Furthermore, we note that all 11 sites nominated as part of the SSA process are coastal locations and, in our discussions with energy companies about river-based sites, some ruled out their development completely and even the most positive regarded them as a low priority (although not totally ruled out in the longer term).
- **Kingsnorth**, noting that the proximity of areas of high population may present problems in relation to licensing and emergency planning. While these are matters for the regulators to consider in consultation with the local authorities' emergency planners when detailed plans for any development are available, it may be that, given these factors, a site so close to a conurbation the size of Greater London and the Medway Towns is not a realistic contender for development. Certainly, in our view, societal risks associated with the development of a new nuclear power station at Kingsnorth will be significantly higher than for similar stations in less populated areas. In addition, even though there is an existing conventional power station nearby, it may still be challenging to demonstrate that a new nuclear power station at Kingsnorth could operate without there being an adverse impact on the nearby internationally designated sites.

We further conclude that none of these three sites is a contender for early deployment. The basis for this judgement is both the clear lack of interest shown by energy companies in any of these sites for the development of new nuclear power stations, and some specific local factors that make development more problematic and time-consuming. These factors include: the complexity of Grid connection and cooling water outfall issues at Druridge Bay, the novel nature of the river-based site (in licensing, logistics and other terms) at Owston Ferry, and issues at Kingsnorth to do with the likely closure and decommissioning of the existing coal station as well as plans (although not yet granted Section 36 consent) for new conventional power stations in the immediate vicinity. Overall, we judge that the impact on deployment (and therefore delay) could be significant.

- 5.2 Beyond these three alternative sites we believe that it would be reasonable to conclude that, on the basis of current information and technology, there are no other areas or sites *worthy of further consideration* for the purposes of the Nuclear NPS.
- 5.3 Given that this is a strategic-level study, drawing largely on national datasets, we have also not had the benefit of local site studies or from discussions with landowners, local authorities or (beyond the material set out in Chapter 2) with energy companies themselves.
- 5.4 In identifying an area or site as *worthy of further consideration*, we are signalling that we believe it may have merit as a potential site for development of one or more new nuclear power stations by 2025, but further thought would need to be given by DECC before any decisions about its suitability could be taken. In identifying a site as *not worthy of further consideration*, we are not saying that we believe it should be irrevocably ruled out from future development. In putting forward a detailed proposal, an energy company may be able, at some future stage, to conceive actions or steps that minimise or mitigate the concerns that we have identified.

Appendices

Appendix A

List of Strategic Siting Assessment (SSA) Criteria and 'Flag for Local Consideration' criteria, including how they have been adapted for this Study

The Final SSA Criteria

Criterion related to nuclear safety		
Criteria	Status in SSA process	Status in Atkins Study
Flooding, tsunami and storm surge	Discretionary	Discretionary (we apply the Exception Test and, in some cases, the Sequential Test and take into account reasonable possible mitigation measures)
Coastal processes	Discretionary	Discretionary (we take into account reasonable countermeasures)
Proximity to hazardous industrial facilities and operations	Discretionary	Discretionary
Proximity to civil aircraft movements	Discretionary	Discretionary
Demographics	Exclusionary	Exclusionary
Proximity to military activities	Exclusionary and discretionary	Exclusionary and discretionary

Criterion related to societal issues		
Criteria	Status in SSA process	Status in Atkins Study
Areas of amenity, cultural heritage and landscape value	Discretionary	Discretionary

Criterion related to operational requirements		
Criteria	Status in SSA process	Status in Atkins Study
Size of site to accommodate operation	Discretionary	Areas that have less than 1 km ² of land suitable for 'defence-in-depth' are excluded; for areas that meet this requirement it is discretionary (and consideration includes unsuitable topography and land use factors such as major roads, rivers, railway lines and other obstructions that cannot reasonably be moved).
Access to suitable sources of cooling	Discretionary	Areas that are more than 2 km from a large body of water are excluded. (A large body of water is taken to be the coast (including estuarine) and major rivers with a fluvial flow rate of greater than 20 m ³ s ⁻¹ at least 95% of the time; for areas that meet this requirement it is discretionary (and consideration includes cliff height and distance to deep water (if on the coast)).

Criterion related to environmental protection		
Criteria	Status in SSA process	Status in Atkins Study
Internationally designated sites of ecological importance	Discretionary	Areas which are located within such designations are excluded from the Study. Areas which are located in close proximity to such areas are treated as discretionary.
Nationally designated sites of ecological importance	Discretionary	Discretionary

'Flag for Local Consideration' criteria

These criteria usually need detailed site-specific investigations and data and are more appropriately assessed at local level. They are therefore not part of the SSA Criteria but will form an important consideration at the development consent stage.

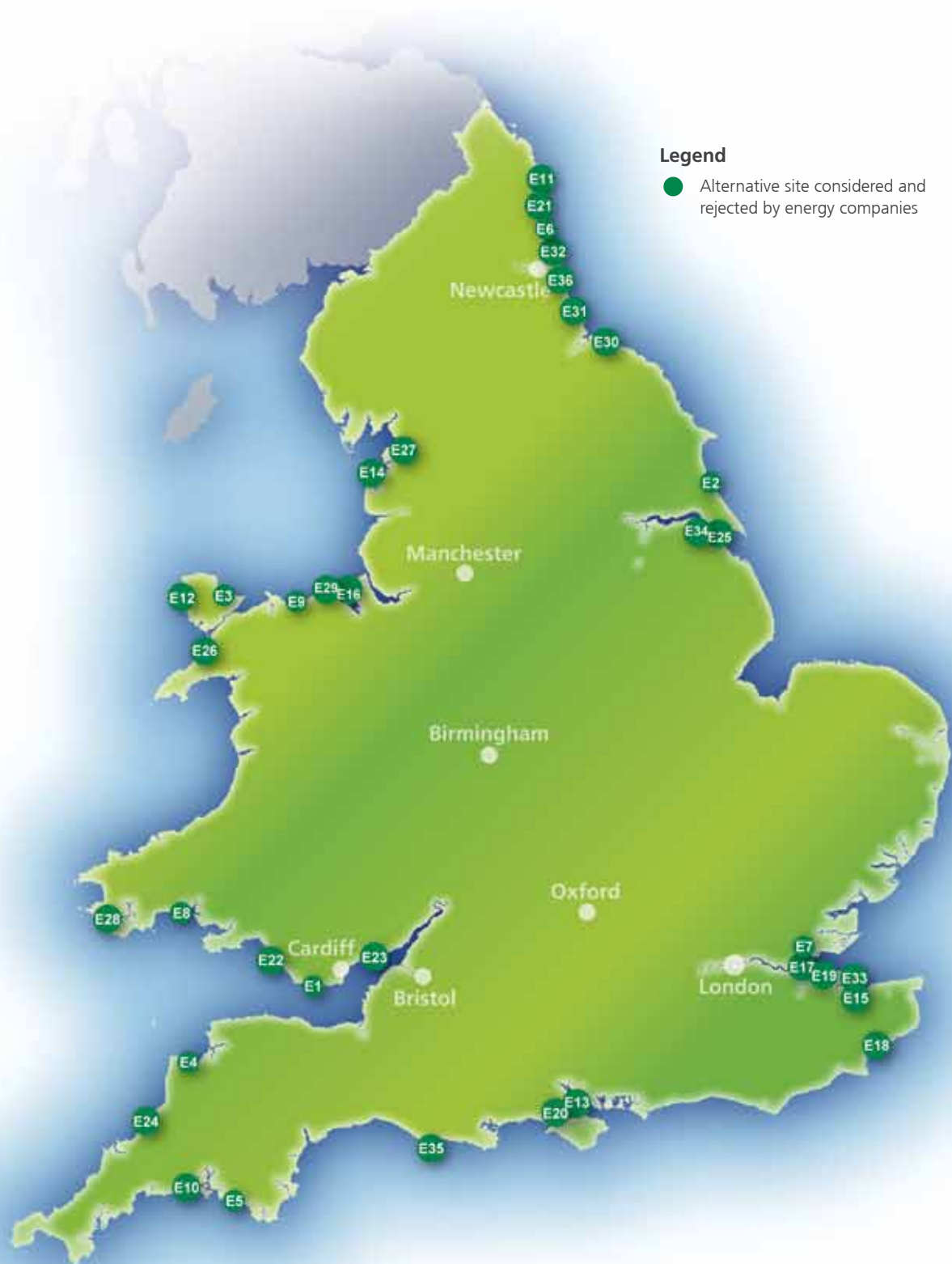
Criterion related to nuclear safety		
Criteria	Status in SSA process	Status in Atkins Study
Seismic risk (vibratory ground motion)	Flag for local consideration	Not assessed
Capable faulting	Flag for local consideration	Not assessed
Non-seismic ground conditions	Flag for local consideration	Not assessed
Meteorological conditions	Flag for local consideration	Not assessed
Proximity to civil aircraft movements	Flag for local consideration	Not assessed
Proximity to mining, drilling and other underground operations	Flag for local consideration	Not assessed

Criterion related to societal issues		
Criteria	Status in SSA process	Status in Atkins Study
Significant infrastructure / resources	Flag for local consideration	Not generally assessed; although existence of significant infrastructure could be a land use factor that could affect the assessment of the Size of Site criterion.

Criterion related to operational requirements		
Criteria	Status in SSA process	Status in Atkins Study
Access to transmission infrastructure	Flag for local consideration	Not assessed
Size of site to accommodate construction and decommissioning	Flag for local consideration	Not assessed. However, the 1 km ² figure used for the Size of Site screening above has some regard for the area to be large enough for construction and decommissioning as well as operations (otherwise, while a new nuclear station could be operated, it could never be build and would fail to meet the deployability by 2025 requirement).

Appendix B

Map of alternative sites and areas considered and rejected by energy companies
(See Table 2.1 for more information on these sites and areas)



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Note: The locations shown above represent approximate locations of alternative areas considered by industry as detailed shapes and sizes of these locations are not visible at this scale.

Appendix C

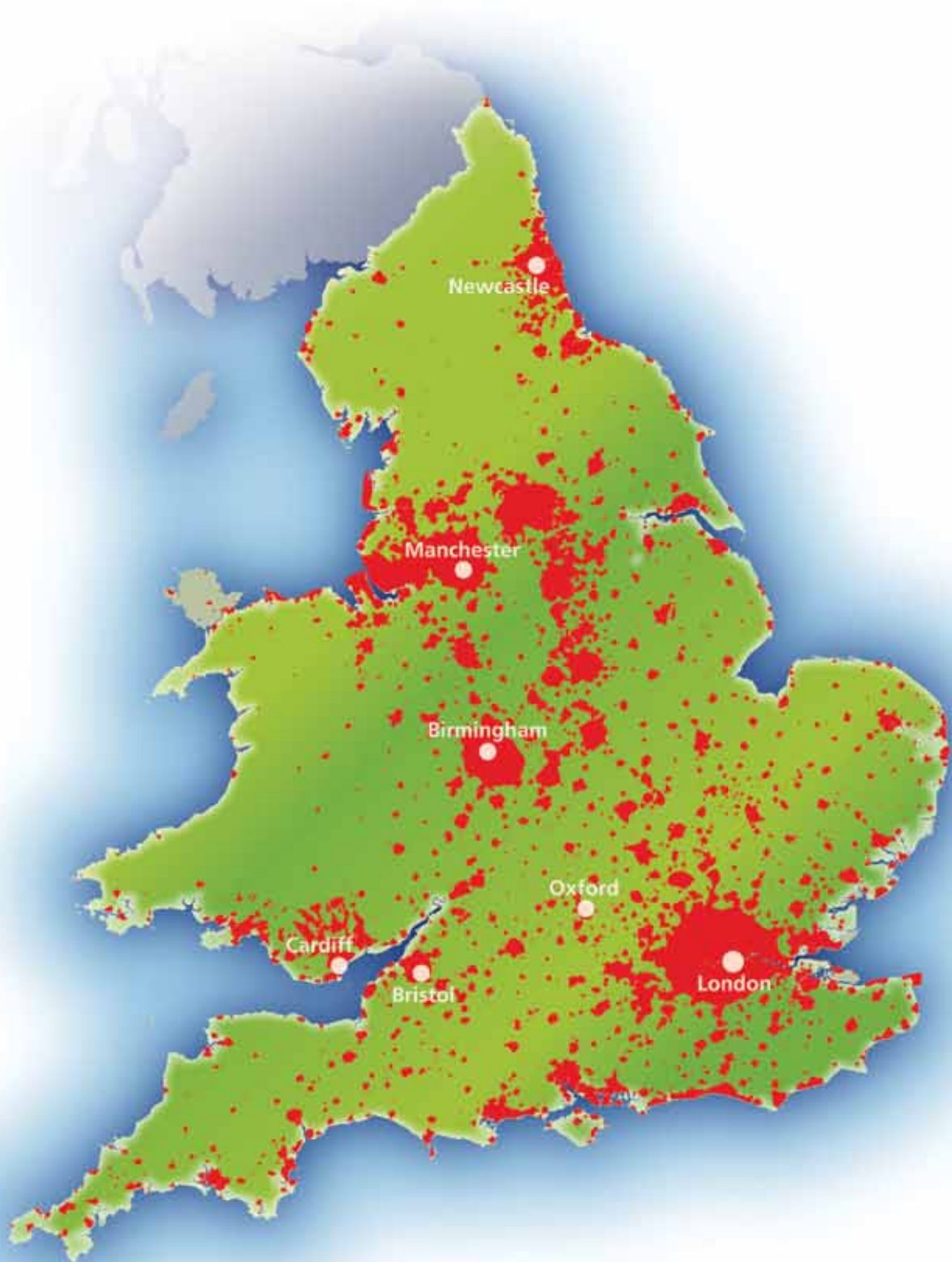
Map of alternative sites derived from historical sources for which we can be clear about the location
(See Tables 3.1, 3.2 and 3.3 for more information on these sites and areas)



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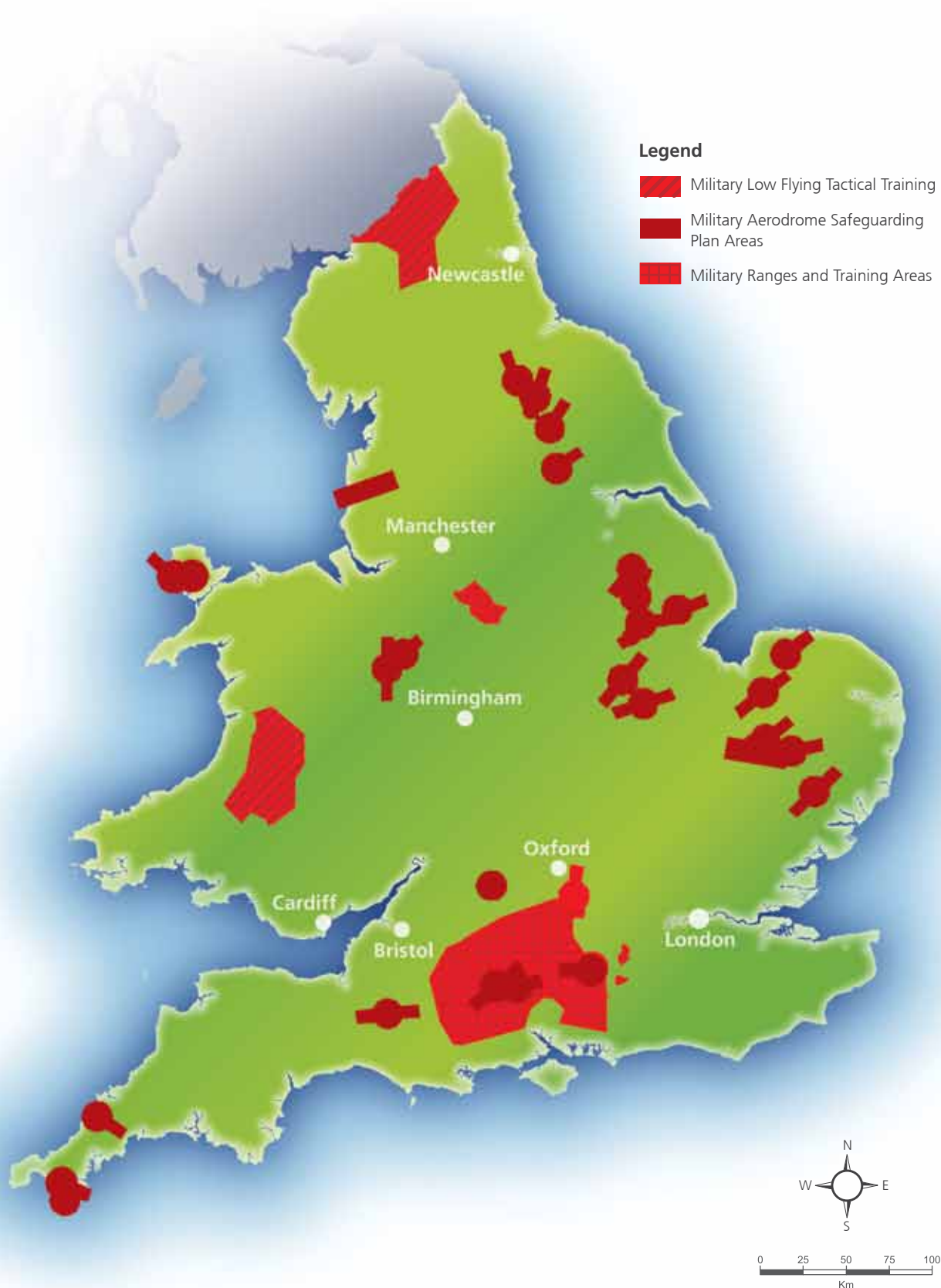
Appendix D1

Map showing the parts of England and Wales excluded as a result of the demographic criterion (C1)



Appendix D2

Map showing the parts of England and Wales excluded as a result of the exclusionary military activities criterion (C2)

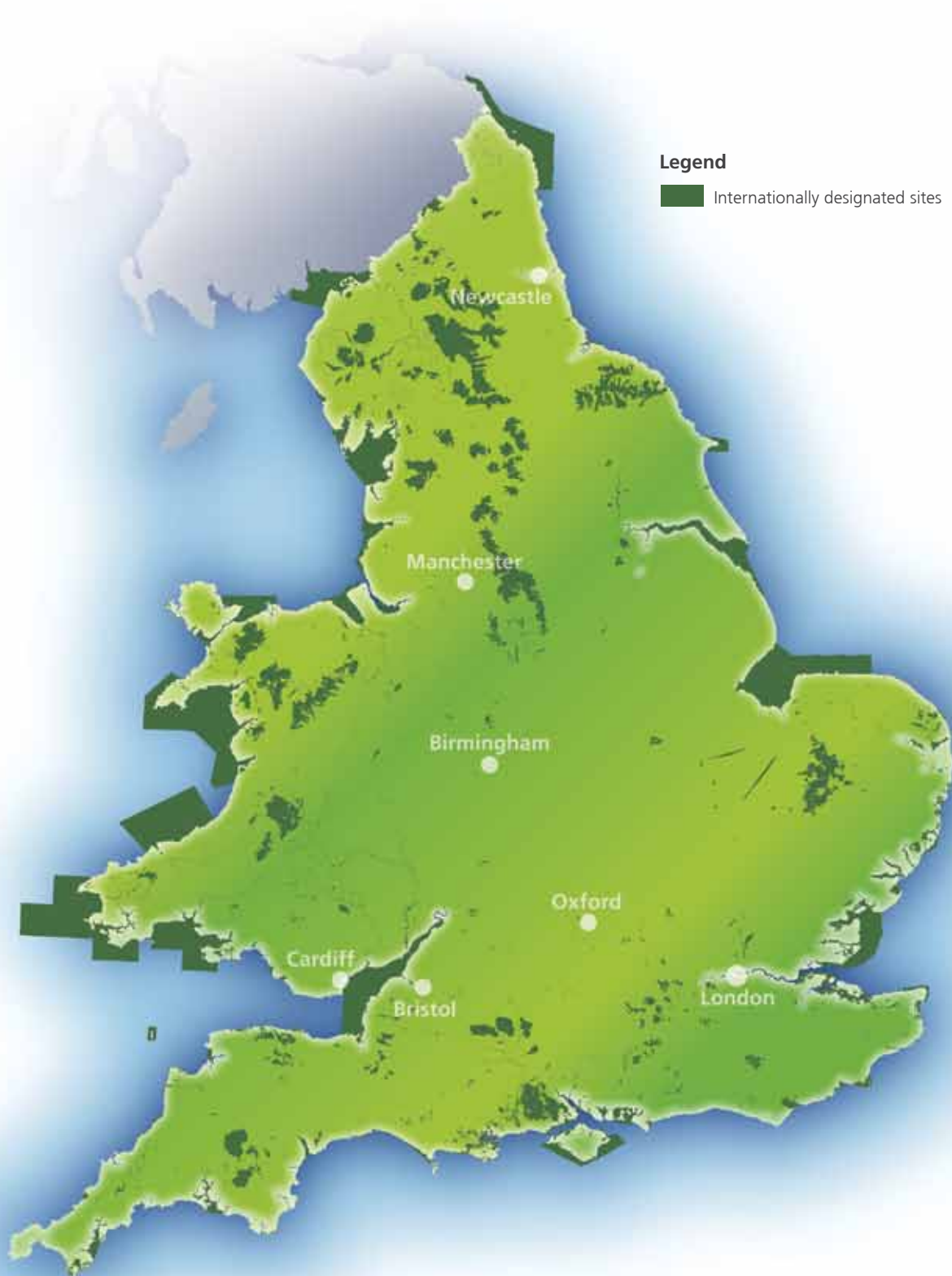


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Appendix D3

Map showing the location of internationally designated sites of ecological importance in England and Wales (D6)



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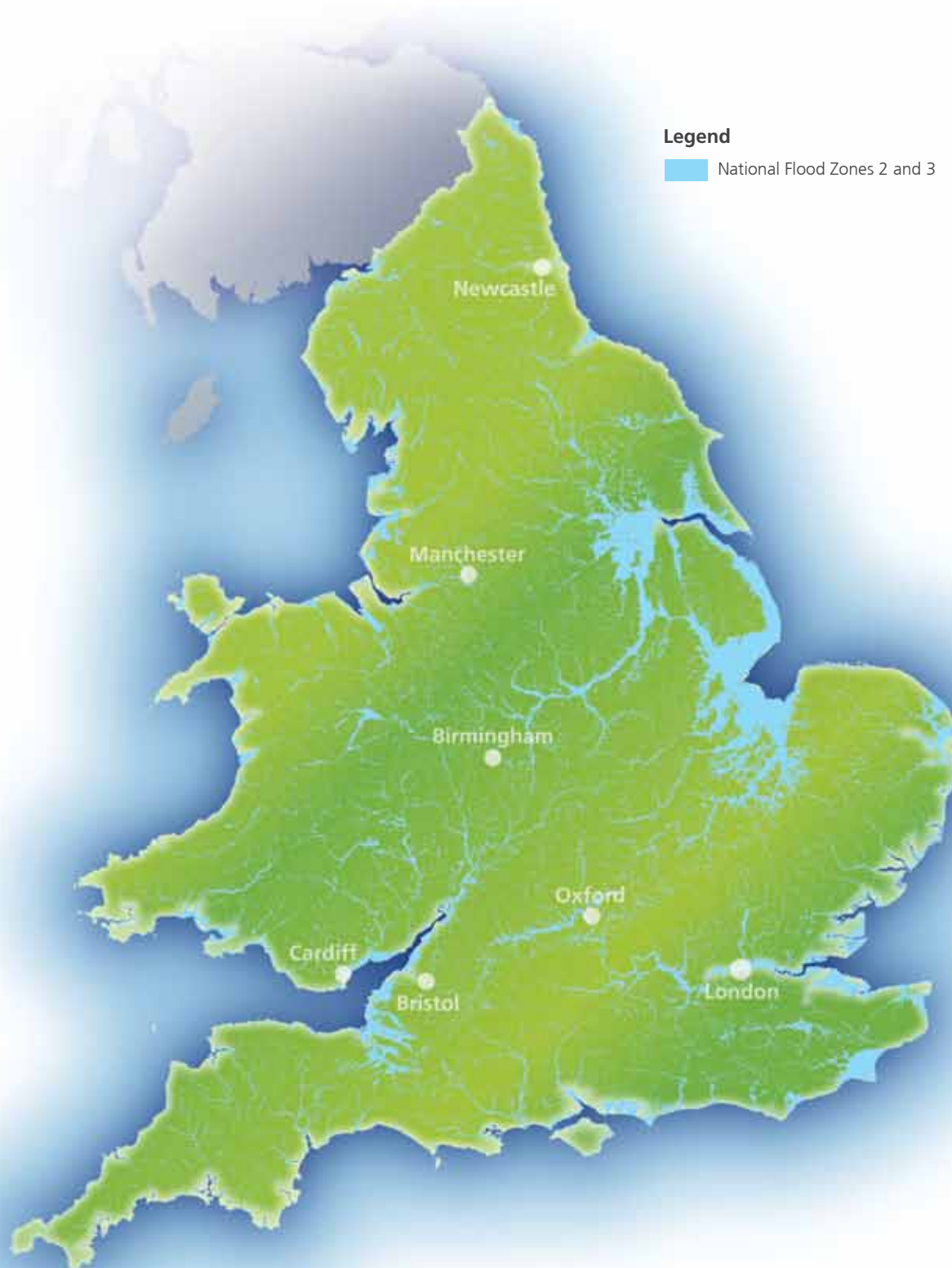
Appendix D4

Map showing the parts of England and Wales that are within 2 km of a substantial body of water (and therefore meet criterion D10 (access to a suitable source of cooling))



Appendix D5

Map showing parts of England and Wales affected by flood risk (D1)

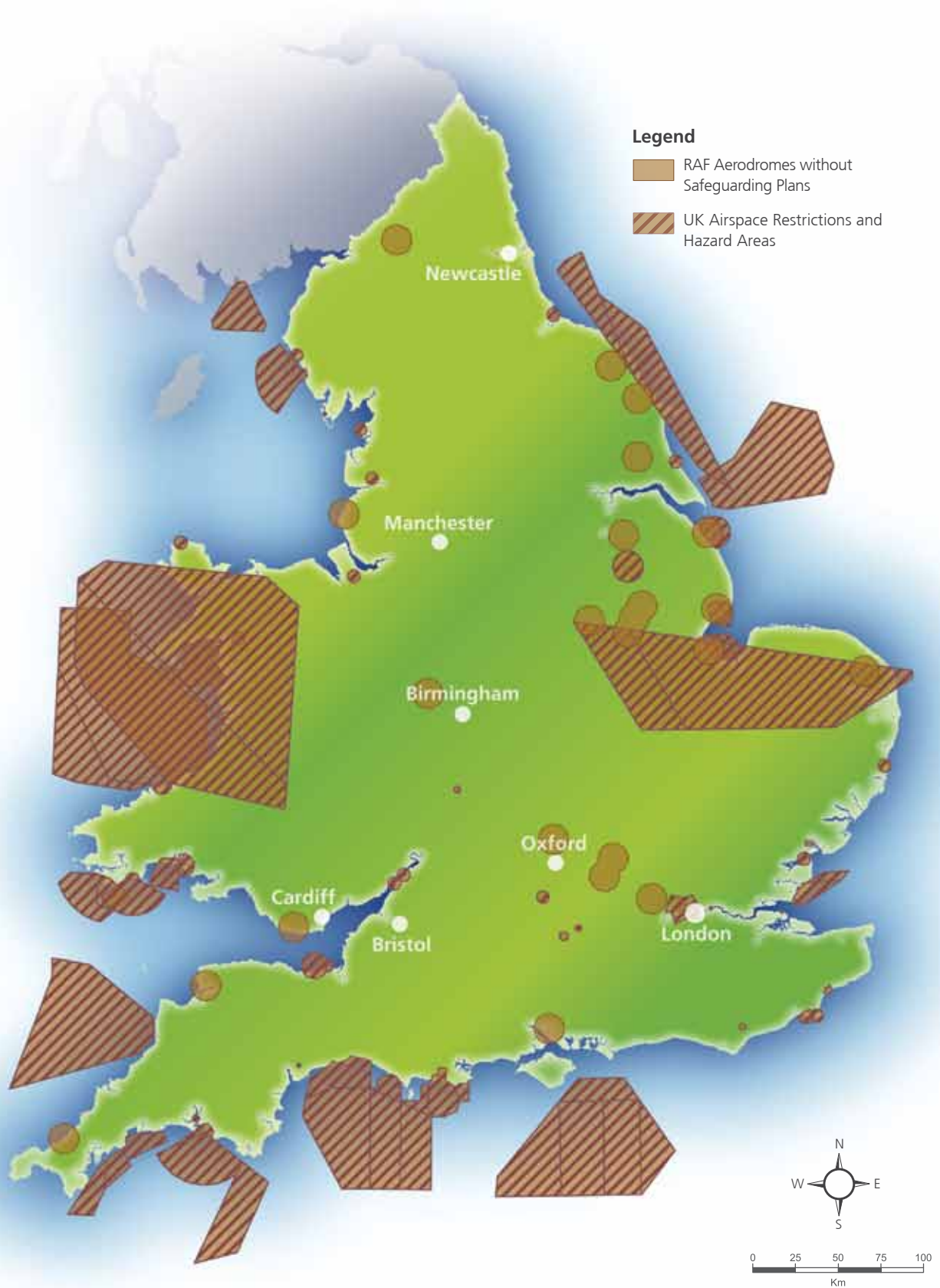


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EA Flood zones: © Environment Agency copyright 2009. License No. A773

Appendix D6

Map showing parts of England and Wales affected by discretionary military activities (D5)

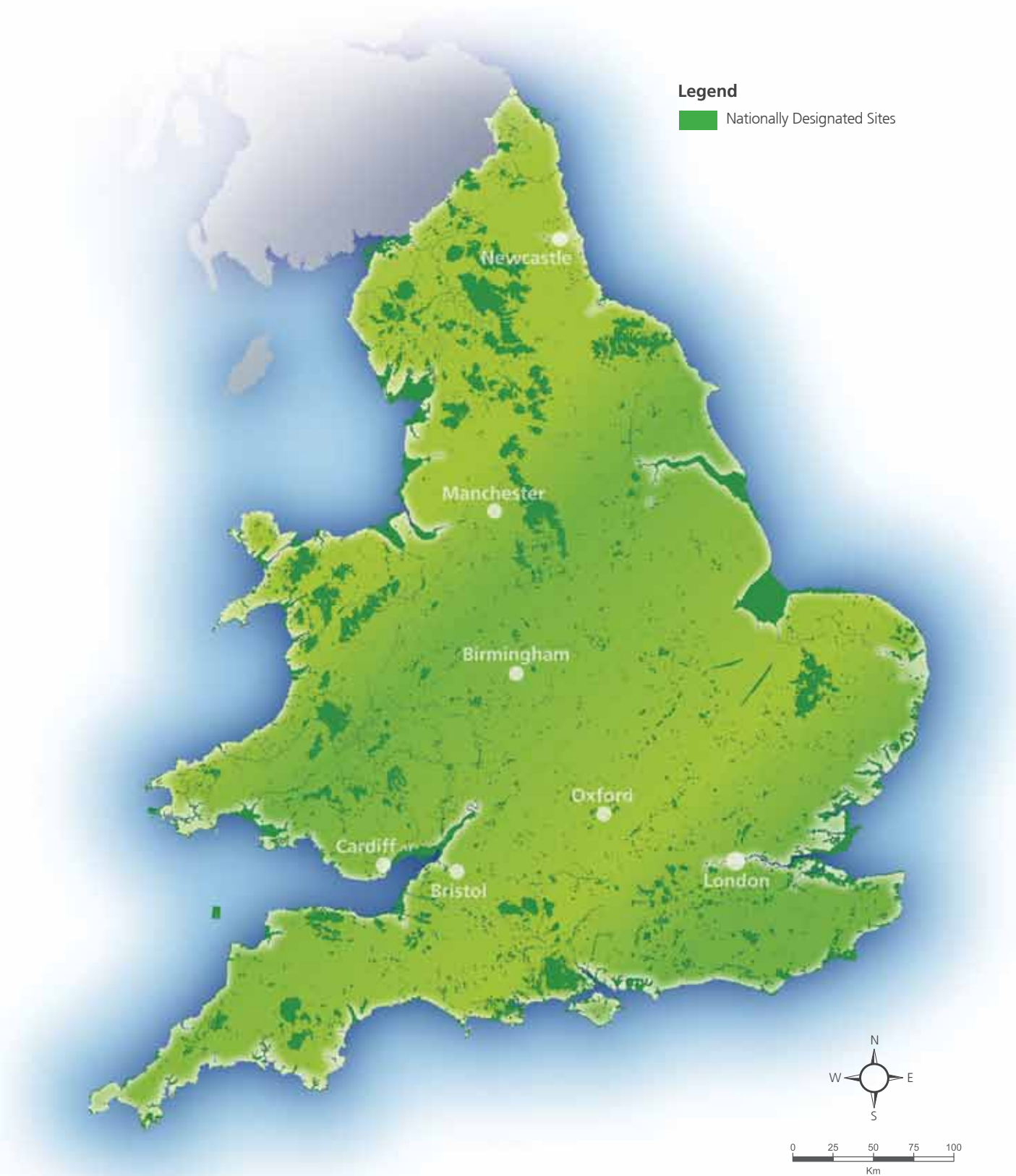


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Note: Aerial Tactical Areas, Transit Areas and Avoidance Areas are not displayed on this map but were considered in the assessment.

Appendix D7

Map of England and Wales showing nationally designated sites of ecological importance (D7)

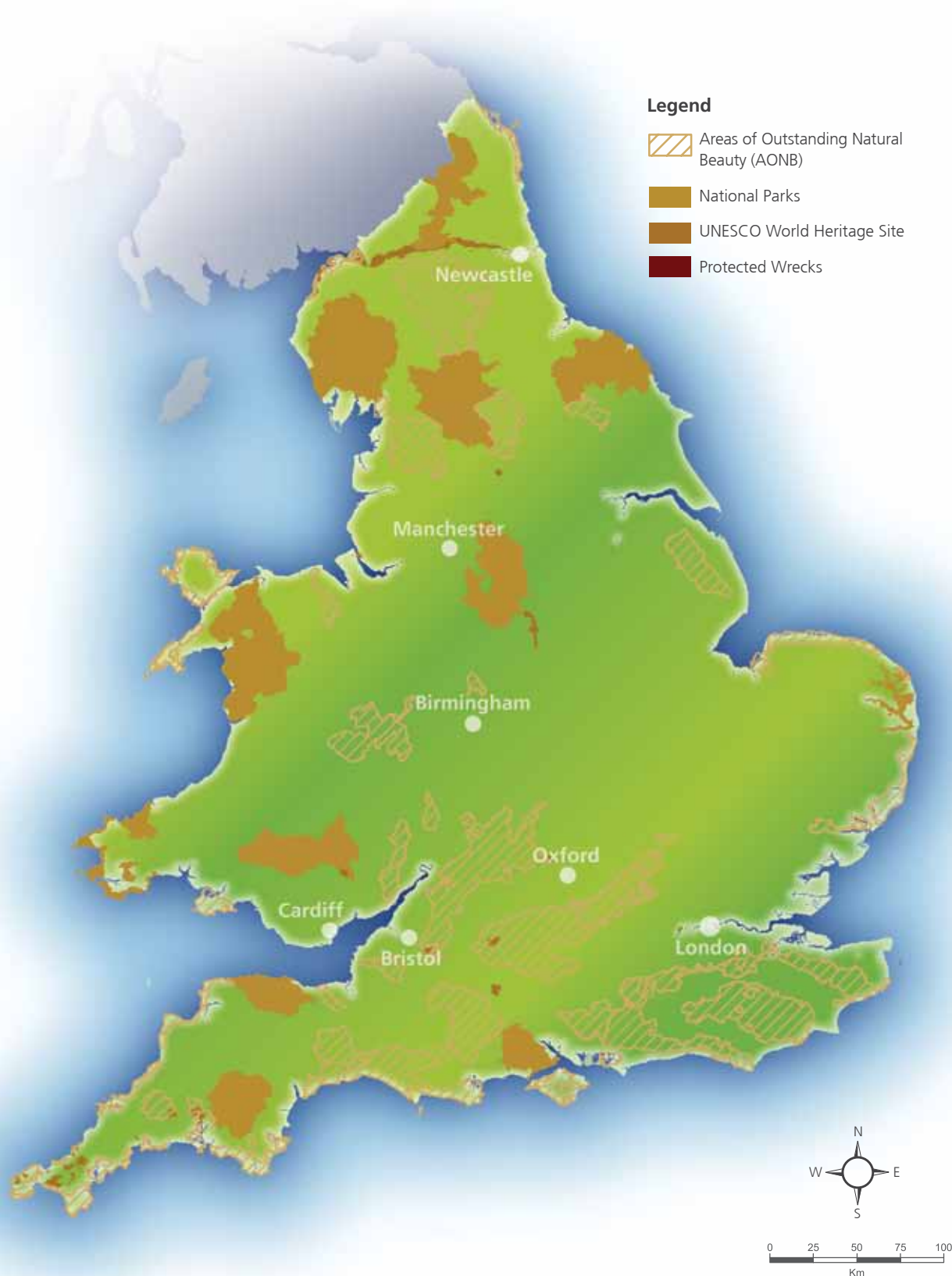


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Appendix D8

Map of England and Wales showing areas of amenity, cultural heritage and landscape value (D8)



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Appendix E – Technical Justifications

Appendix E1

Technical justification for the superiority of sites within 2 km of a substantial body of water to provide a continuous source of cooling

To ensure safe and efficient operation, nuclear power stations require continuous cooling to generate electricity. From a cooling perspective most sites in England and Wales could, provided the considerable technical challenges and costs were able to be met, be designed to operate a modern nuclear reactor safely.

For the purposes of this screening exercise, only sites which are within 2 km of existing substantial bodies of water with sufficient quantities of cooling water have been considered.

To explain the technical justification behind this approach, it is helpful to start with a brief overview of the three main forms of cooling systems, as shown in Table E1.1.

Table E1.1 Description of three main forms of cooling systems

Cooling Technology	Brief Description
Once through wet systems (Direct cooling)	<p>Once through wet systems draw in large quantities of water from major sources of water (large lakes and rivers, estuaries or the sea) and the waste heat from the power station is passed to this directly via condensers.</p> <p>The heated water then flows directly back to the source and discharges via an outfall.</p> <p>This form of cooling is often referred to as direct cooling.</p>
Cooling towers (Indirect cooling)	<p>Some sites may have problems operating using direct cooling due to insufficient water availability, recirculation of the outfall water back into the inlet or environmental concerns from the water temperature rise caused by the outfall.</p> <p>As an alternative to direct cooling, heat can be rejected to the environment by means of cooling tower technology. There are several main types which are in operation around the world including:</p> <ul style="list-style-type: none">• Natural Draft;• Wet Mechanical Draft;• Wet / Dry Hybrid Mechanical Draft; and• Abated Reduced Plume Mechanical Draft. <p>In general, these cooling systems make use of the latent heat of vaporisation. The warm water is sprayed into a large tower, some of the water evaporates and the updraft takes this water vapour into the atmosphere. The technologies listed above vary in tower height required and whether a plume of rising steam is visible.</p> <p>For all these cooling water types, make up water is required to replace the lost evaporated water which is drawn from a nearby water body (typically 1% of the total flow).</p> <p>Quantities of water required from nearby water bodies in these cooling systems are much smaller than once through systems although there are often losses in efficiency of the station compared to direct cooling – particularly if energy is required to operate the cooling towers.</p> <p>Additionally, in order to avoid the build up of various salts causing scaling in the cooling system, some water is replaced (at least another 1% of the total flow) and the effluent must be discharged.</p> <p>This form of cooling is referred to as indirect cooling.</p>

Cooling Technology	Brief Description
Air Cooling	<p>Power plants can be cooled simply by air, without relying on the physics of evaporation. Generally, these work like a car radiator and employ high-flow forced draft past a system of finned tubes in the condenser through which the steam passes, simply transferring its heat to the ambient air directly.</p> <p>Air cooling usually involves greater cost for the cooling set-up and is less efficient than wet systems, since the only cooling is by relatively inefficient heat transfer from steam or water to air via metal fins, not by evaporation.</p>

At the time of writing this Study, there is very limited experience worldwide in the sole use of air-cooled technologies in nuclear power stations. According to a 2008 US Department of Energy report, less than 1% of any thermal electricity generation in the US used air cooling technologies.¹³ The use of forced draught air-cooled systems alone to ensure adequate and reliable cooling for a large (1000 MW+) nuclear power station would pose significant technical challenges. The need for reliable cooling at all times would make it extremely difficult for a developer to provide a safety case for such a power station which would satisfy the stringent requirements of the UK safety regulators. We judge that proposals to use such cooling systems for commercial nuclear power stations in the foreseeable future are extremely unlikely.

Whilst the exact volumes of water needed at a site will largely depend on the cooling technology choice, sufficient volumes of water will need to be available at all times, including in emergency situations.

In certain circumstances, significant engineering works can be undertaken to ensure adequate water is available even if there are constraints on the naturally occurring sources. For example, at the river-based Civaux Nuclear Station in France, six upstream dams have been built to store 20 million cubic metres of water, to ensure adequate water is still available to the station even in extreme drought conditions.¹⁴

For the purposes of this alternatives study, it is not reasonable to investigate all possible technological solutions to sites which may not have sufficient existing cooling water available. Therefore, we have only looked for areas or sites where, from an access to cooling water perspective, there appears to be sufficient existing cooling water available to site at least one nuclear power station. We regard any area or site that fails to meet this requirement as *not worthy of further consideration*.

Similarly, the distance of the nuclear station from the cooling water source can also be varied. Theoretically, it may be possible to site the station several kilometres away from the source. However, in practice siting is usually as close to the source as possible to minimise security concerns make planning consent more straight forward and reduce costs. For the purposes of this alternatives study, a reasonable distance of a maximum of 2 km from the water source has been assumed. All 11 sites nominated as part of the SSA process are within 2 km of the water source.

For England and Wales, the existing water sources which could potentially cool a nuclear power station are discussed in Table E1.2.

¹³ National Energy Technology Laboratory, Department of Energy, Estimating Freshwater Needs to Meet Future Thermoelectric Generation Requirements, pg 13, 2008, http://www.netl.doe.gov/technologies/coalpower/ewr/pubs/2008_Water_Needs_Analysis-Final_10-2-2008.pdf

¹⁴ World Association of Nuclear Operators, Volume 9, #3, 2001, pg 6, Civaux NPP http://www.wano.org.uk/WANO_Documents/Inside_WANO/Vol9No3/Vol9No3_E.pdf

Table E1.2 Naturally occurring water sources

Naturally Occurring Water Source	Brief Description
The Sea	<p>Cooling a nuclear station using water taken from the sea has a number of advantages not least the fact that, unlike river or lake sources, there is access to a very large quantity of water meaning that more efficient direct cooling can usually be used.</p> <p>The geography of England and Wales also means there is a large proportion of coastline compared to the land area of the interior. Historically, nuclear power stations in England and Wales have been situated near the coast (the exception being Trawsfynydd). All current operational stations in England and Wales are sited near the coast or near estuaries and all nominations as part of the SSA process are for coastal or estuarine locations.</p> <p>From the perspective of the cooling water screen as part of Stage 1 of our screening exercise, all areas within 2 km of coastal locations are included.</p>
Estuaries	<p>Cooling a nuclear station using water taken from estuaries is clearly possible. Several historical and operational sites in the UK are estuary-based. Water volumes available are generally more dependent on the local conditions and can be influenced by tidal and fluvial factors. Direct or indirect cooling may be possible depending on the particular location.</p> <p>From the perspective of the cooling water screen as part of Stage 1 of our screening exercise, all areas within 2 km of estuaries are included.</p>
Rivers	<p>England and Wales have a large number of rivers with a wide variety of flow rates at different locations along their paths.</p> <p>Siting of nuclear (and other power stations) at river locations is commonplace throughout the world. In comparison to rivers around the world, rivers in England and Wales are relatively small and the majority of these are likely to be too small to support nuclear stations safely without significant additional technical solutions.</p> <p>The rate of flow is the key factor in determining whether the river can support the cooling requirements of a nuclear power station. If there is insufficient access to cooling water then there is a risk that the nuclear station could not operate safely.</p> <p>Nuclear stations are only economic if they provide base load electricity supply (i.e. they are close to full load for the majority of their generating lifetime). To achieve this, sufficient volumes of water would need to be available at all times, in all seasons and during extreme weather events.</p> <p>The quantities of water needed for direct cooling (around $90 \text{ m}^3\text{s}^{-1}$)¹⁵ mean no river in England and Wales is capable of supporting this capacity. However, for indirect cooling, much less water is needed (at least $2 \text{ m}^3\text{s}^{-1}$). Using information on the flow rates of rivers in England and Wales, sections of rivers were identified for further consideration as part of this alternatives study. These calculations are set out in Appendix E2. From the perspective of the cooling water screen as part of Stage 1 of our screening exercise, all areas within 2 km of the rivers that have sufficient water flow are included.</p> <p>Beyond the availability of cooling water, there are a number of other concerns and challenges around river-based siting. These are set out in paragraph 4.19.</p>

¹⁵ Note that these figures are for a single unit. It is commonplace for twin stations to be constructed on one site. For twin stations, all values quoted need to be doubled. This does not affect the arguments presented here for coastal or estuary sites, which have, for all practical purposes, unlimited access to cooling water provided the intake pipe is taken out to deep water.

Naturally Occurring Water Source	Brief Description
Lakes	<p>England and Wales have a large number of lakes of various depths and sizes.</p> <p>Lakes, both man-made and naturally occurring, can be used to cool nuclear power stations. The now decommissioned 500 MW station at Trawsfynydd used a man-made lake with a surface area of approximately 5 km².</p> <p>As this Study is only considering sites with existing sources of cooling water, engineered solutions such as those used at Trawsfynydd are not considered further.</p> <p>For a lake-based site, the key limiting factors which determine whether they will be able to support a nuclear station are:</p> <ul style="list-style-type: none"> the effect on the temperature uplift of the lake and the associated impact on the environment; whether evaporation rates for cooling purposes will exceed the rate at which water is replenished naturally (e.g. rainfall, river inflow sources); and the build up of radioactive discharges over the lifetime of the site. <p>In general terms, the larger the lake size, the easier it is to manage impacts of this nature. As is the case with rivers, lakes in England and Wales are generally considered relatively small. Many of our largest lakes are also situated within National Parks, so would be unlikely to be <i>worthy of further consideration</i>.</p> <p>There are few precedents for the nuclear development of lake-based sites in the UK, so the development of safety cases and other consent documentation may be more difficult and time-consuming.</p> <p>Radioactive discharges from lake-based sites do not, in themselves, preclude operation of a station at a lake; the discharges will be such that dose constraints are unlikely to be exceeded as a consequence either of the discharges themselves, or of the build-up of radioactivity in sediments. However, such build-up has occurred at Trawsfynydd, and although the concentration of radio nuclides is very low and unlikely to give rise to excessive doses, the future deliberate contamination of sediments in today's climate of environmental awareness is likely to be challenged.</p> <p>Modern nuclear reactors will have very low radioactive discharges and will need to operate in accordance with the statutory limits on doses and, more importantly, the Best Available Techniques (BAT) principle, by which discharges should be optimised using modern abatement technology. Further guidance on the subject of radioactive discharges can be found on the Environment Agency website.¹⁶</p> <p>For the purpose of this Study, we have not considered lake-based sites further for the reasons set out above.</p>

Given the information and assumptions presented above, we therefore believe that it is a legitimate and helpful shortcut for a screening exercise to rule out sites that do not have a substantial body of water already in place to provide a continuous supply of cooling water to a reactor. For the purpose of our screening exercise, we take this to be within 2 km of the coast, estuary or a river with a sufficient flow rate.

¹⁶ Environment Agency guidance documents for nuclear licensed site operators <http://www.environment-agency.gov.uk/business/sectors/32533.aspx>

Appendix E2

Calculations used to find rivers of significant flow

This section sets out the calculations we used to identify rivers in England and Wales with a sufficient flow rate potentially to supply the cooling water required as set out in Appendix E1.

Demand for cooling water

Based on a set of generic assumptions we estimate the cooling water demand of a directly cooled 1600 MW power station is in the order of $90 \text{ m}^3\text{s}^{-1}$, whilst the demand of an indirectly cooled 1600 MW power station is in the order of $2 \text{ m}^3\text{s}^{-1}$ for fresh water. The exact cooling water requirements will vary greatly dependent on site-specific conditions, design and constraints but for the purposes of a national screening study we believe these values are reasonable.

Supply of cooling water from rivers

River water must be available for cooling a nuclear power station during periods of low as well as high flow. There are a number of hydrological measures that could be used to express these periods of low flow and for the purpose of this Study the Q95 (or flow in a river that is exceeded on average 95% of the time) has been selected. This represents a common measure of low flow that can be readily obtained from existing datasets and reasonably applied to a national screening exercise. We note that in a feasibility study for a particular site, modelling of the extreme low flows would need to be carried out. Sufficient cooling water to shut down the reactor safely must be available at all times.

An important consideration is the proportion of flow in rivers that can be made available for abstraction in relation to environmental concerns and the needs of other users downstream of the abstraction and, in particular, in the reach between the abstraction and location at which cooling water is returned to the river. The UK Technical Advisory Group on the Water Framework Directive¹⁷ provides guidance for consumptive use abstractions (those that do not return all abstracted water to the river, such as indirect cooling) limiting them to between 7.5% and 20% of the natural Q95 flow – a common limit is 10%. For a predominantly non-consumptive use (such as direct cooling) it would be highly unlikely that abstractions of more than 50% of flow (before returning) would be acceptable.

Based on the information presented above we can estimate the river flow needed to sustain the direct and indirect cooling water demand of a nuclear power station as follows:

- A **directly cooled** station requiring a $90 \text{ m}^3\text{s}^{-1}$ cooling water supply (assuming a possible maximum acceptable abstraction of 50%) needs a river flow of at least $180 \text{ m}^3\text{s}^{-1}$. Here we assume the Q95 must be at least $180 \text{ m}^3\text{s}^{-1}$ for screening purposes.
- An **indirectly cooled** station requiring a $2 \text{ m}^3\text{s}^{-1}$ cooling water supply (assuming a possible maximum acceptable abstraction of 10%) needs a river flow of at least $20 \text{ m}^3\text{s}^{-1}$. Here we assume the Q95 must be at least $20 \text{ m}^3\text{s}^{-1}$ for screening purposes.

¹⁷ UK Technical Advisory Group on the Water Framework Directive, UK ENVIRONMENTAL STANDARDS AND CONDITIONS (PHASE 1), Final report, April 2008, (SR1 – 2006) Centre for Ecology and Hydrology

Rivers in England and Wales able to meet cooling water demands of nuclear power stations

We identified all large river catchments in England and Wales (catchments with an area of greater than 2,000 km²). For each catchment we estimated the gauged and natural Q95 flows at a gauged location at or near the normal tidal limit. The gauged Q95 flows were taken from the UK National River Flow Archive¹⁸. The natural Q95 flows were estimated using a statistical method based on catchment characteristics (Low Flows 2000^{19,20}). Gauged flows and estimated natural flows for the same location will differ for two principal reasons. First the estimated natural flow will not account for the effect of discharges and abstractions that are explicitly captured in the gauged flow. Second the natural flow is an estimate based on statistical analysis, and is therefore subject to error. We used both gauged and natural flows in this Study because the effect of abstractions and discharges can be pronounced at low flows, and can vary substantially through time. An understanding of the natural flow is therefore a useful context in which to make an assessment of the available water in a river.

A review of the gauged and natural flows reveals that there are no rivers in England and Wales with a Q95 even close to 180 m³s⁻¹. For the purposes of this Study we have therefore concluded that direct cooling from non-tidal rivers is not feasible in England and Wales.

Only one river in England and Wales (the Trent) has a (gauged) Q95 in excess of the 20 m³s⁻¹ that we have chosen as the screening threshold for indirect cooling. A review of National Flow Archive records for upstream gauges at Colwick (SK620399) and Shardlow (SK448299) indicates that this 20 m³s⁻¹ threshold is crossed at a location somewhere between these two gauges (we have assumed a location in the vicinity of Long Eaton near Nottingham). For the purposes of this Study we have assumed that the only stretch of non-tidal river in England and Wales that could support indirect cooling is the Trent downstream of Long Eaton.

¹⁸ Centre for Ecology and Hydrology (<http://www.ceh.ac.uk/data/nrfa/index.html>)

¹⁹ Young A. R., Grew R. and Holmes M.G.R. (2003). Low Flows 2000: A national water resources assessment and decision support. Water Science and Technology, 48 (10).

²⁰ Holmes, M.G.R., Young, A.R., Gustard, A.G. and Grew, R. (2002b). A Region of Influence approach to predicting Flow Duration Curves within ungauged catchments. Hydrology and Earth System Sciences. 6(4) 721-731

Appendix E3

Justification for the size of site

We have applied judgements on how to apply the size of site for operation criterion (D9) at all stages of our screening exercise. This appendix sets out what we have done and the rationale for it.

Stage 1

The SSA process does not set a minimum limit on the nominated size of site. Rather, criterion D9 requires that the site must be large enough to “demonstrate that it is reasonable to conclude there is enough land within the boundary... for the secure operation of at least one new nuclear power station”. The availability of land is of particular relevance in the context of security arrangements required for nuclear power station sites. The Government, through the regulating body of the Office for Civil Nuclear Security (OCNS) requires operators to adopt the concept of ‘defence-in-depth’ in protecting nuclear power stations.²¹ The 11 nominations as part of the SSA process range in size from approximately 70 hectares (0.7 km²) to 300 hectares (3 km²). The area nominated for operation does not include additional land which may be needed for construction and decommissioning.

OCNS have estimated that approximately 30 hectares (0.3 km²) is required as a minimum to provide effective defence-in-depth for plant important to the safe operation of the nuclear power station. However, this is not sufficient for a site to be suitable or potentially suitable for one or more new nuclear power stations. First, there will need to be sufficient room for non-radiological plant (such as a National Grid electricity transmission station and, if indirect cooling is used, cooling towers) and space for ancillary facilities (for example, administrative facilities and for off-site parking). Secondly, it needs to be practicable for the station to be constructed and decommissioned, which will require additional land than is purely required for operations. Therefore, although the relevant discretionary criterion D9 relates to ‘size of site for operations’ the minimum total amount of land required for a site to be viable must be significantly larger than 0.3 km². After discussion with OCNS and Nuclear Installations Inspectorate (NII), we set the figure for land required as part of Stage 1 to be 1 km², all of which must be suitable for ‘defence-in-depth’ and at least 0.3 km² of which must also pass the demographic criterion as this will contain the nuclear island.

This is not to say that it is not possible to develop sites with an area of between 0.3 km² and 1 km². In putting forward a detailed proposal an energy company may be able to show how such a development is practicable and consistent with the other constraints of nuclear siting. Any such proposal would then need to be considered on its merits at the relevant time. However, for a screening exercise, without the benefit of such detailed consideration of site layout issues we think that a minimum size of 1 km² is appropriate and OCNS have indicated they are content with this approach.

In carrying out this analysis, there were 261 areas greater than 1 km² in size and these pass through automatically to Stage 2. There were 80 areas between 0.3 km² and 1 km² in size. Of these, 69 had insufficient available land for ‘defence-in-depth’ and were not considered further; nine areas passed through to Stage 2 and two contained or were close to nominated sites and were not considered. Table E3.1 shows these 80 sites and our conclusions on each. The nine areas from this group that passed to Stage 2 (S02, S13, S39, S42, S59, S60, S65, S67, S68) are considered further and appear, using this numbering system, at the end of Table 4.2.

²¹ ‘Defence-in-depth’ is defined by the IAEA as “a concept used to design security systems that require an adversary to overcome or circumvent multiple obstacles, either similar or diverse, in order to achieve his objective”.

Stage 2

At Stage 2, we identify as *not worthy of further consideration* areas that have passed Stage 1 of our screening process but, after consideration of other SSA criteria and local factors, less than 1 km² remains of the area. After discussion with OCNS, to ensure alternative sites identified would reasonably be able to meet the concept of 'defence in depth', the following factors have been used at a local level to inform our judgement of this issue:

- the local topography of the area;
- roads which cross the area;
- public footpaths which cross the area; and
- nearby land use issues.

Each of these factors creates potential security issues which may make an area *not worthy of further consideration*. Clearly our judgement cannot replace that of a regulator, or accurately represent the various mitigation actions industry could take for a prospective site. However, for each of the issues listed above, we have taken judgements based on general advice provided by ONCS, as to whether it is reasonable to conclude that the areas are of sufficient size and, therefore, whether the area or site is *worthy of further consideration*.

Table E3.1: Areas between 0.3 km² and 1 km² assessed as to whether there is sufficient land for 'defence-in-depth'

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
S01	0.4	G7 – England and Wales South of Bowness on Solway	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S02	0.8	G7 – England and Wales West of Barrow on Furness	Pass to Stage 2	
S03	0.3	G7 – England and Wales North of Morecambe	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S04	0.3	G7 – England and Wales East of Blackpool	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S05	0.6	G7 – England and Wales North of Formby	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S06	0.5	G7 – England and Wales South of Colwyn Bay	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S07	0.6	G7 – England and Wales West of Llandudno	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S08	0.6	G7 – England and Wales East of Conwy	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S09	0.8	G7 – England and Wales South of Llanfairfechan	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S10	0.3	G7 – England and Wales The Skerries	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S11	0.7	G7 – England and Wales South of Caernarfon	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S12	0.4	G7 - England and Wales South of Llandanwg	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S13	0.9	G7 - England and Wales South of Pembroke	Pass to Stage 2	
S14	0.4	G7 - England and Wales South of Kidwelly	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
S15	0.6	G7 – England and Wales West of Gorseinon	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S16	0.3	G7 – England and Wales East of Swansea	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S17	0.5	G7 – England and Wales South of Colwyn Bay	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S18	0.7	G7 – England and Wales South of Cardiff	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S19	0.6	G7 – England and Wales South of Newport	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S20	0.4	G7 – England and Wales South of Chepstow	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S21	0.7	G7 – England and Wales West of Bristol	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S22	0.8	G7 – England and Wales West of Minehead	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S23	0.5	G7 – England and Wales South of Lynmouth	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S24	0.3	G7 – England and Wales Noth of Martinhoe	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S25	0.7	G7 – England and Wales South of St Austell	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S26	0.4	G7 – England and Wales West of Brixham	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S27	0.6	G7 – England and Wales East of Totnes	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S28	0.8	G7 – England and Wales North of Exminster	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
S29	0.5	G7 – England and Wales North of Colyford	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S30	0.8	G7 – England and Wales Portland Bill	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S31	0.9	G7 – England and Wales South of Fortuneswell	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S32	0.3	G7 – England and Wales North of Fortuneswell	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S33	0.5	G7 – England and Wales South of Swanage	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S34	0.6	G7 – England and Wales South of Wareham	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S35	0.8	G7 – England and Wales North of Wareham	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S36	0.7	G7 – England and Wales South of Poole	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S37	0.7	G7 – England and Wales East of Bournemouth	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S38	0.7	G7 – England and Wales North of Sandown	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S39	1.0	G7 – England and Wales North of Hythe	Pass to Stage 2	
S40	0.5	G7 – England and Wales North of Southampton	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station)
S41	0.5	G7 – England and Wales South of Hedge End	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S42	0.8	G7 – England and Wales East of Hedge End	Pass to Stage 2	

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
S43	0.9	G7 – England and Wales East of Fareham	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S44	0.4	G7 – England and Wales North of Portsmouth	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S45	0.3	G7 – England and Wales East of Emsworth	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S46	0.4	G7 – England and Wales North of Bosham	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S47	0.7	G7 – England and Wales North of Newhaven	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S48	0.6	G7 – England and Wales North of Eastbourne	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S49	0.3	G7 – England and Wales North of Eastbourne	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S50	0.7	G7 – England and Wales West of Bexhill	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S51	0.8	G7 – England and Wales South of Rye	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S52	0.7	G7 – England and Wales South of Rye	The area was not considered as it is close to a proposed site (Dungeness) nominated as part of the SSA process.	
S53	0.6	G7 – England and Wales South of Lydd	Area around nominated site (Dungeness) not considered. Other parts of the area are <i>not worthy of further consideration</i> .	
S54	0.3	G7 – England and Wales South of Queenborough	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S55	0.4	G7 – England and Wales North of Gillingham	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S56	0.3	G7 – England and Wales South West of Sheerness	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
S57	0.4	G7 – England and Wales Isle of Grain	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S58	0.5	G7 – England and Wales East of Higham	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S59	0.4	G7 – England and Wales West of St.Mary Hoo	Pass to Stage 2	
S60	0.9	G7 – England and Wales South of Stanford-le-Hope	Pass to Stage 2	
S61	0.6	G7 – England and Wales South of Stanford-le-Hope	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S62	0.4	G7 – England and Wales East of Great Wakering	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S63	0.4	G7 – England and Wales North of Great Wakering	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S64	0.4	G7 – England and Wales North of Hullbridge	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S65	0.5	G7 – England and Wales North of Maylandsea	Pass to Stage 2	
S66	0.6	G7 – England and Wales Osea Island	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S67	0.7	G7 – England and Wales East of Brightlingsea	Pass to Stage 2	
S68	0.4	G7 – England and Wales West of Walton-on-the-Naze	Pass to Stage 2	
S69	0.3	G7 – England and Wales North of Walton-on-the-Naze	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S70	0.5	G7 – England and Wales South of Snape	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S71	0.6	G7 – England and Wales East of Middleton	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).

Area Number	Area Size (km ²)	Map Location	Atkins' view	Rationale
S72	0.4	G7 – England and Wales North of Hopton	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S73	0.6	G7 – England and Wales South of Scratby	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S74	0.4	G7 – England and Wales North of Goole	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S75	0.4	G7 – England and Wales South of Scarborough	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S76	0.5	G7 – England and Wales West of Middlesbrough	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S77	0.7	G7 – England and Wales East of Chester-le-Street	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S78	0.5	G7 – England and Wales East of Prudhow	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S79	0.4	G7 – England and Wales West of Newcastle upon Tyne	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).
S80	0.4	G7 – England and Wales East of Berwick-upon-Tweed	<i>Not worthy of further consideration</i>	Size of site (insufficient land in and adjacent to area to reasonably site a nuclear station).

Appendix F

Details of the Geographical Information System capability applied to this Study

Approach

This Study of alternatives is based on applying the SSA Criteria to a national screening exercise, rather than an assessment of industry nominated sites. This required:

- the development of appropriate datasets to match, where possible, the SSA Criteria and allow an analysis to be made across the whole country; and
- the application of judgement from technical experts on how the data should be applied to particular sites and areas.

This task was made much more manageable and robust through the use of an internet based Geographical Information System (GIS) that allowed datasets to be overlayed over a map of England and Wales to a high level of detail and accuracy. This Spatial Data Infrastructure (SDI) is based on Autodesk MapGuide Enterprise but was customised to meet the needs of this project.

Initially, Ordnance Survey topographic data at a scale of 1:250,000 were incorporated into the SDI. However, after selection of certain sites for screening at a more detailed level, larger scale maps at 1:50,000 scale were also displayed in order to provide more detailed local map content.

Overall, the use of a GIS approach provided an invaluable visual assessment tool for the assessment of alternative sites.

Data

The data used for the project was sourced from the Ordnance Survey and various other English and Welsh national and local data providers. They were processed, quality checked, recorded in a metadata catalogue and loaded into the web mapping tool. Some of the datasets were digitised from graphic outputs where electronic datasets were not available.

The spatial resolution and accuracy of data used in the Study is generally based on 1:250,000 topographic data. The error margin generally equates to +/- 25 m based on 0.1 mm digitising accuracy of 1:250,000 OS Strategi datasets. The site selection at a minimum size of 1 km² would therefore allow for an error margin of +/- 625 m². As some of the datasets were produced at a lower or higher spatial accuracy, mismatches between those datasets may be observed on some of the maps. While Atkins checked the quality of the data which were collated, digitised or analysed, we cannot guarantee the quality of data obtained from external sources.

The datasets used in the GIS database are set out in Table F.1:

Table F.1 Constraints and associated datasets used in the GIS

Criteria	Title	Source	Spatial resolution / scale	Dataset reference date
Demographic criteria (C1)	Population Exclusionary Factor (Semi Urban)	Processed by Atkins from data derived from the national population database (Health and Safety Laboratory)	500 m	10/04/2008
Proximity to military activities (C2)	Military Aerodrome Safeguarding Plan Areas	Digitised from Pooleys Flight Planning Chart	N/A	01/01/2007
	Military Ranges and Training Areas	Digitised from MOD Defence Estates maps	N/A	08/06/2006
	Military Low Flying Tactical Training Areas	Digitised from 'Low Fly Activity in your Area' interactive map from the MOD website	N/A	17/02/2009
Flood risk (D1)	Flood Zone 2 and Flood Zone 3 areas	Environment Agency	N/A	20/04/2006
Proximity to civil aircraft movements (D4)	Civil aircraft movement	Digitised by Atkins from various local plans		14/05/2009
Proximity to military activities (D5)	RAF Aerodromes without Safeguarding Plans	Digitised from RAF website and Pooleys Flight Planning Chart		01/01/2007
	UK Air Space Restrictions and Hazard Areas	Digitised from Civil Aviation Authority maps and Pooleys Flight Planning Chart		06/03/2006
	UK Areas of Intense Air Activity	Digitised from Civil Aviation Authority maps		08/06/2006

Criteria	Title	Source	Spatial resolution / scale	Dataset reference date
Internationally designated sites of ecological importance (D6)	Ramsar Sites (England)	Natural England	N/A	10/03/2009
	Ramsar Sites (Wales)	Countryside Council Wales	5 m	26/02/2009
	Special Area of Conservation (Wales)	Countryside Council Wales	5 m	05/03/2009
	Special Areas of Conservation (England)	Natural England	N/A	10/03/2009
	Special Protection Area (England)	Natural England	N/A	10/03/2009
	Special Protection Area (Wales)	Countryside Council Wales	5 m	26/02/09
	5 km buffer around internationally designated sites	Processed by Atkins from international designations		10/03/2009
Nationally designated sites (D7)	Marine Nature Reserves (England)	Natural England	Various scales	03/06/2005
	Marine Nature Reserves (Wales)	Countryside Council Wales	5 m	06/08/2007
	National Nature Reserves (England)	Natural England	Various scales	02/02/2009
	National Nature Reserves (Wales)	Countryside Council Wales	5 m	26/02/2009
	Sites of Special Scientific Interest (England)	Natural England	Various scales	10/03/2009
	Sites of Special Scientific Interest (Wales)	Countryside Council Wales	5 m	26/02/2009
	Marine Nature Reserves (Wales)	Countryside Council Wales	5 m	01/01/2005
	National Nature Reserves (England)	Natural England	Various scales	09/10/2006

Criteria	Title	Source	Spatial resolution / scale	Dataset reference date
Areas of amenity, cultural heritage and landscape value (D8)	National Parks (England)	Natural England	Various scales	26/01/2009
	National Parks (Wales)	Countryside Council Wales	Various scales	09/03/2009
	Areas of Outstanding Natural Beauty (England)	Natural England	Various scales	26/01/2009
	Areas of Outstanding Natural Beauty (Wales)	Countryside Council Wales	5 m	15/08/2007
	Protected Wreck Sites (England)	English Heritage	N/A	11/11/2008
	UNESCO World Heritage Sites (England)	English Heritage	Various scales	09/02/2009
	UNESCO World Heritage Sites (Wales)	Cadw (historic environment division, Wales)	Various scale	29/03/2006
	Scheduled Monuments (England)	English Heritage	Various scales	12/01/2009
	Scheduled Monuments (Wales)	Cadw	Various scales	05/11/2007
	Listed Buildings (England)	English Heritage	Various scales	26/09/2007
	Listed Buildings (Wales)	Cadw	Various scales	01/05/2006
Access to suitable sources of cooling (D10)	Access to Cooling Water V7	Atkins processed from OS Strategi coastline	1:250000	26/08/2009

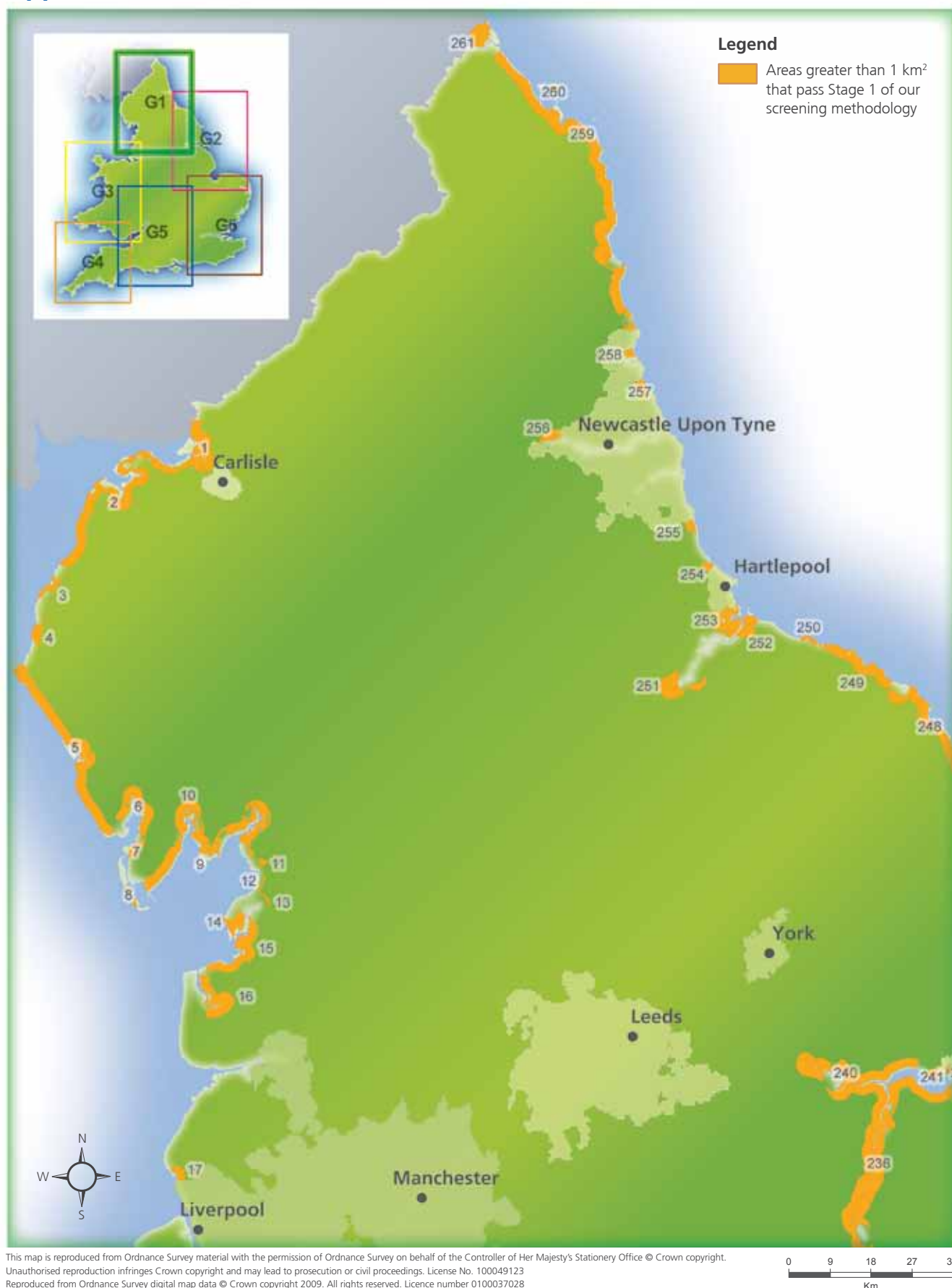
Other information used in mapping

Information type	Title	Source	Spatial resolution / scale	Dataset reference date
Proposed Locations	Energy company alternative locations	Digitised by Atkins based on energy company information		20/03/2009
	Historic alternative sites	Digitised by Atkins based on desktop study of CEGB and other sources		01/05/2009
Energy infrastructure	National Grid	National Grid	1:250000	14/04/2004
Transport infrastructure	Rail	Ordnance Survey Strategi	1:250000	06/10/2006
	Motorway	Ordnance Survey Strategi	1:250000	06/11/2007
	Primary Road	Ordnance Survey Strategi	1:250000	06/11/2007
Hydrography	Rivers with Flow > 20 m ³ s ⁻¹	Dervied from microflow data from Environment Agency	1:250000	03/03/2009
	Rivers	Ordnance Survey Strategi	1:250000	08/11/2007
Settlements	Settlements	Ordnance Survey Strategi	1:250000	06/10/2006
Administration	England and Wales boundary	Ordnance Survey Strategi	1:250000	06/11/2007
Raster base maps	OS 50k topography	Ordnance Survey	1:50000	01/01/2009
	OS 250k topography	Ordnance Survey	1:250000	01/01/2009

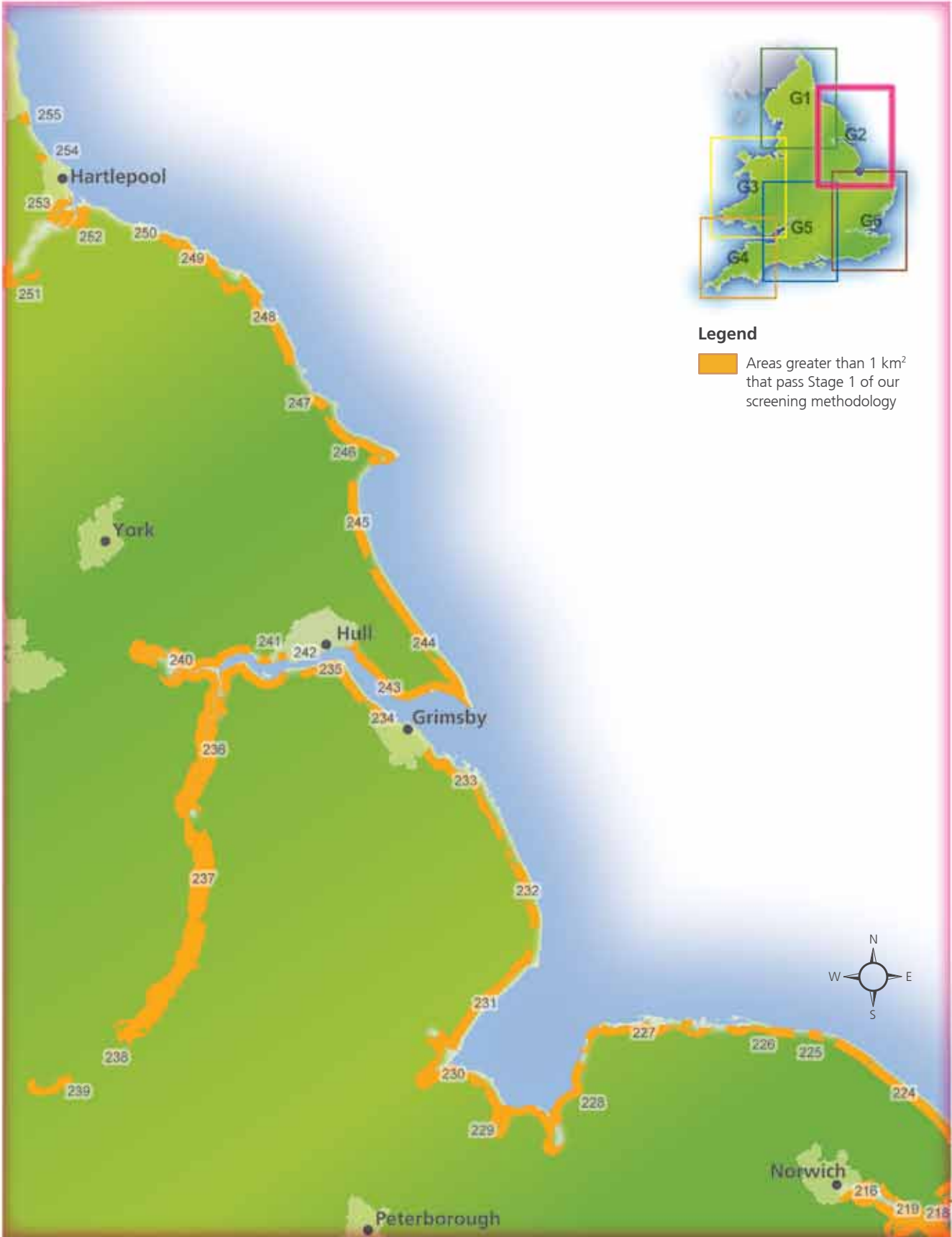
Appendix G

Maps of areas passing Stage 1 of the methodology

Appendix G1 – North

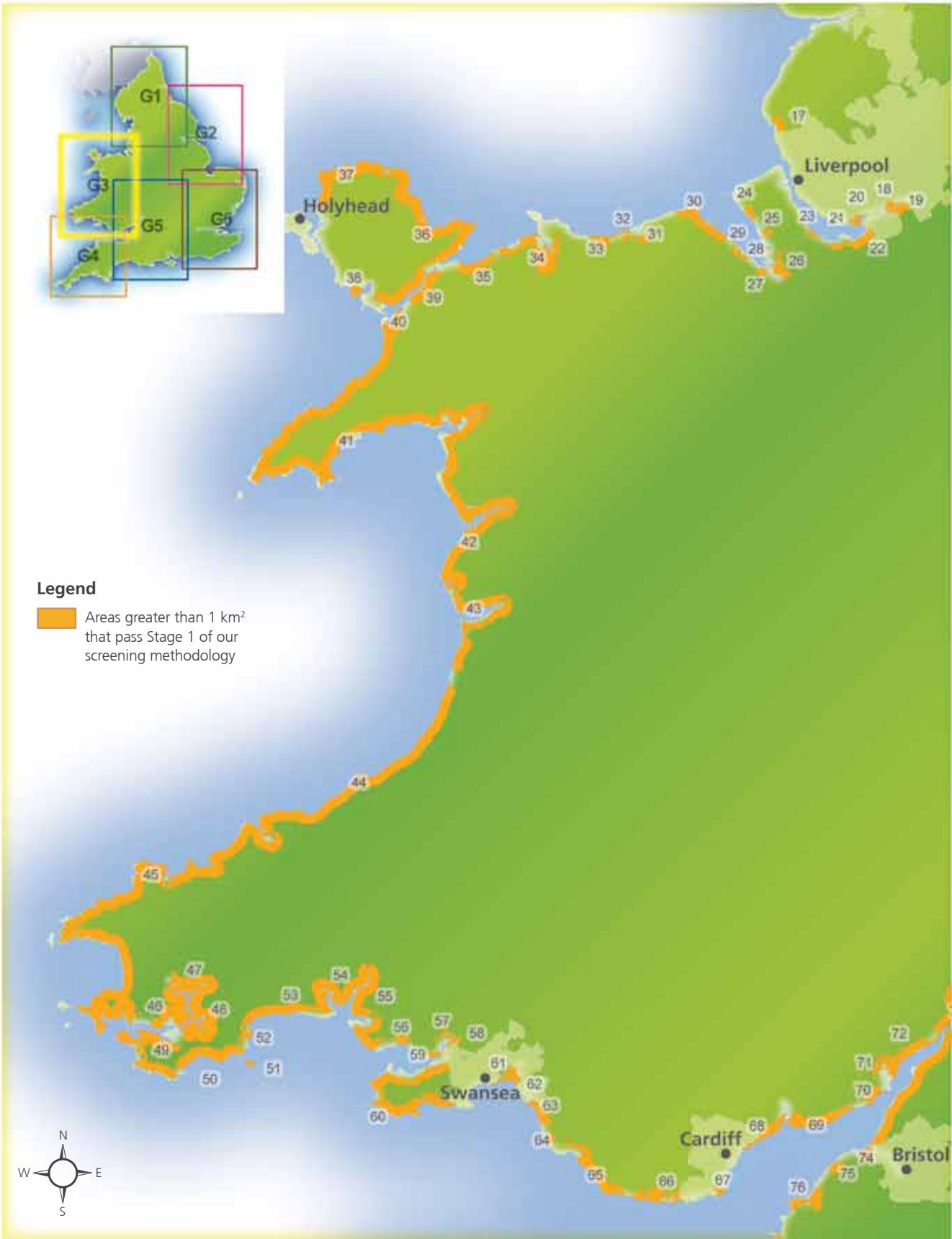


Appendix G2 – North East



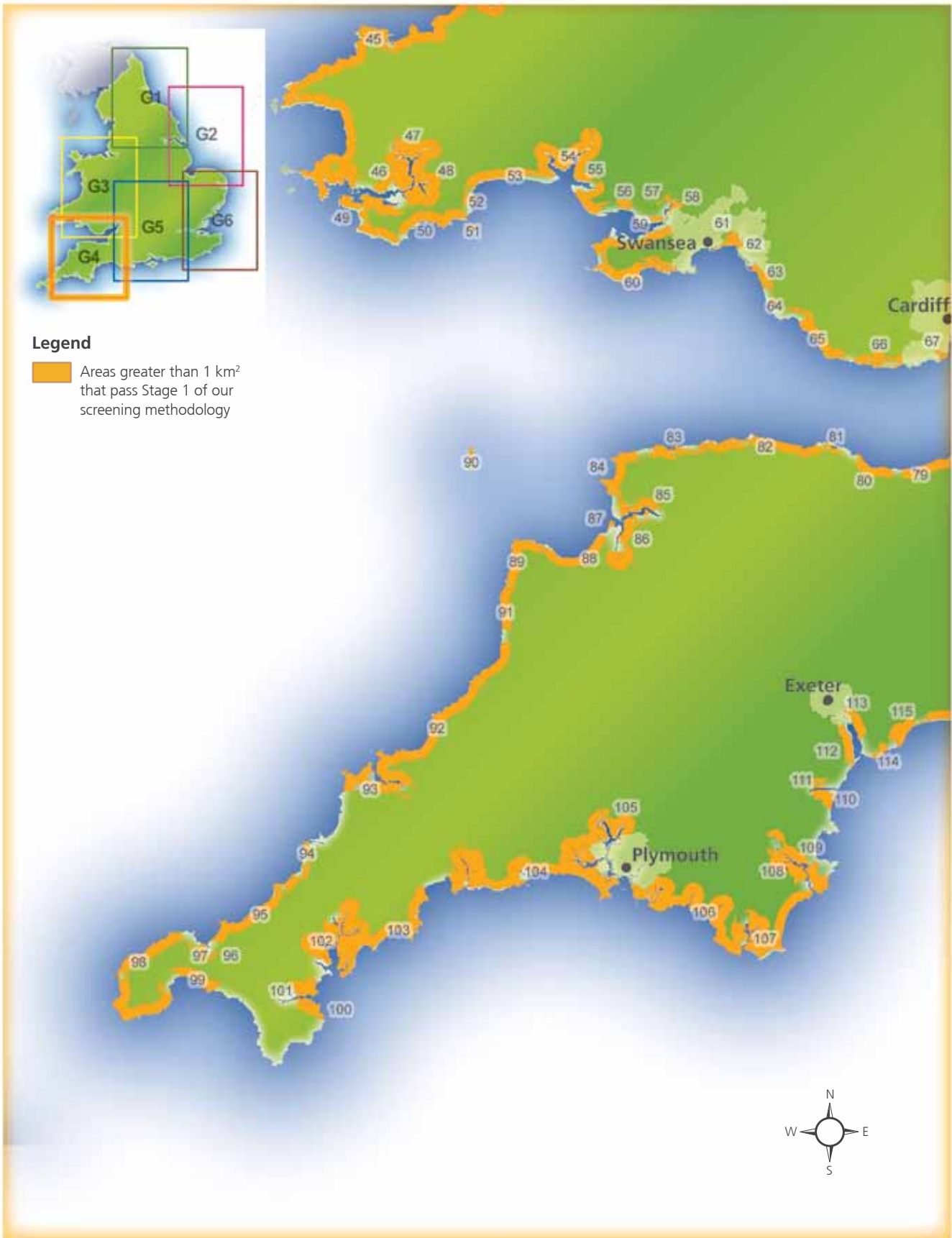
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Appendix G3 – Wales

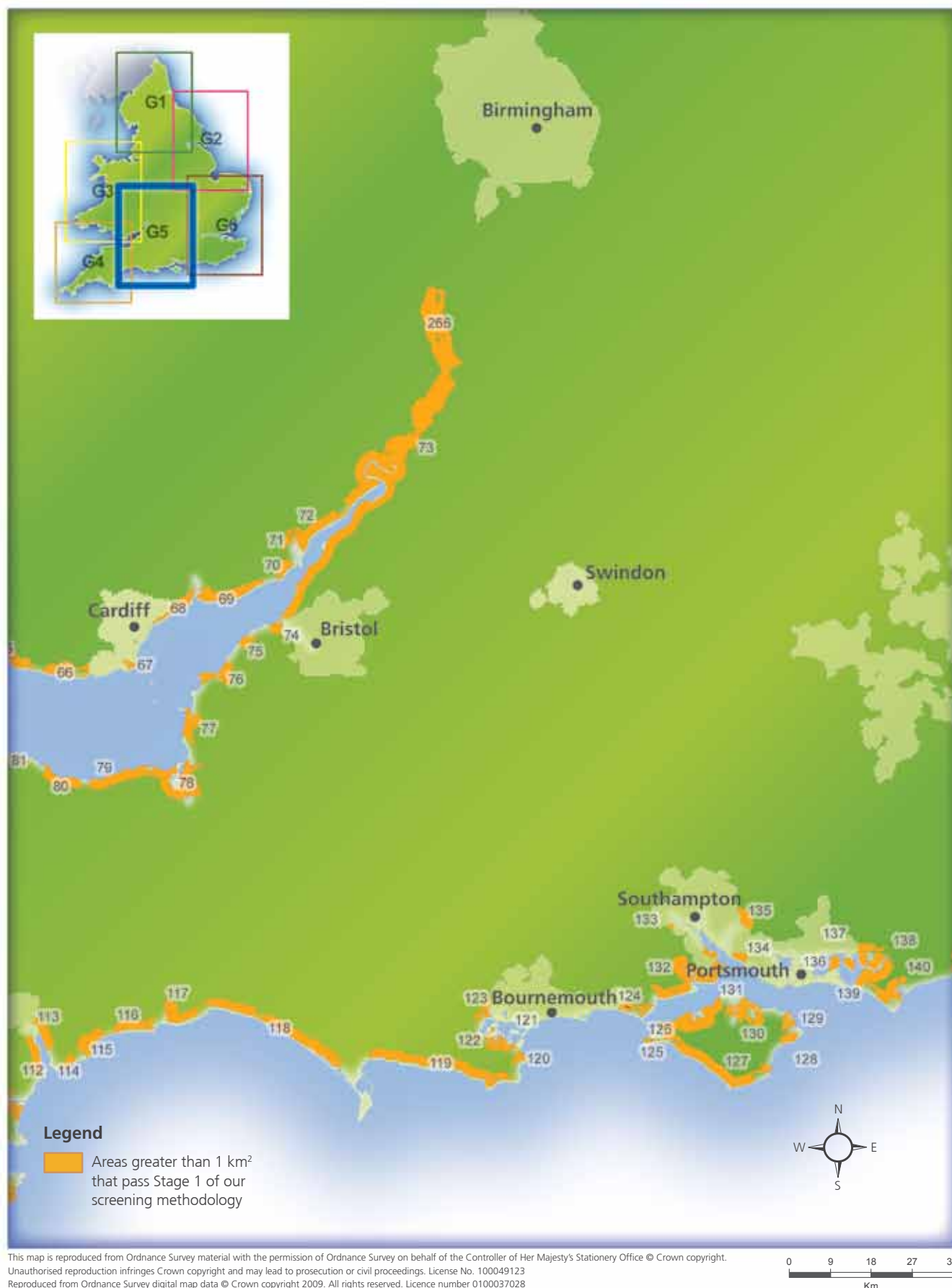


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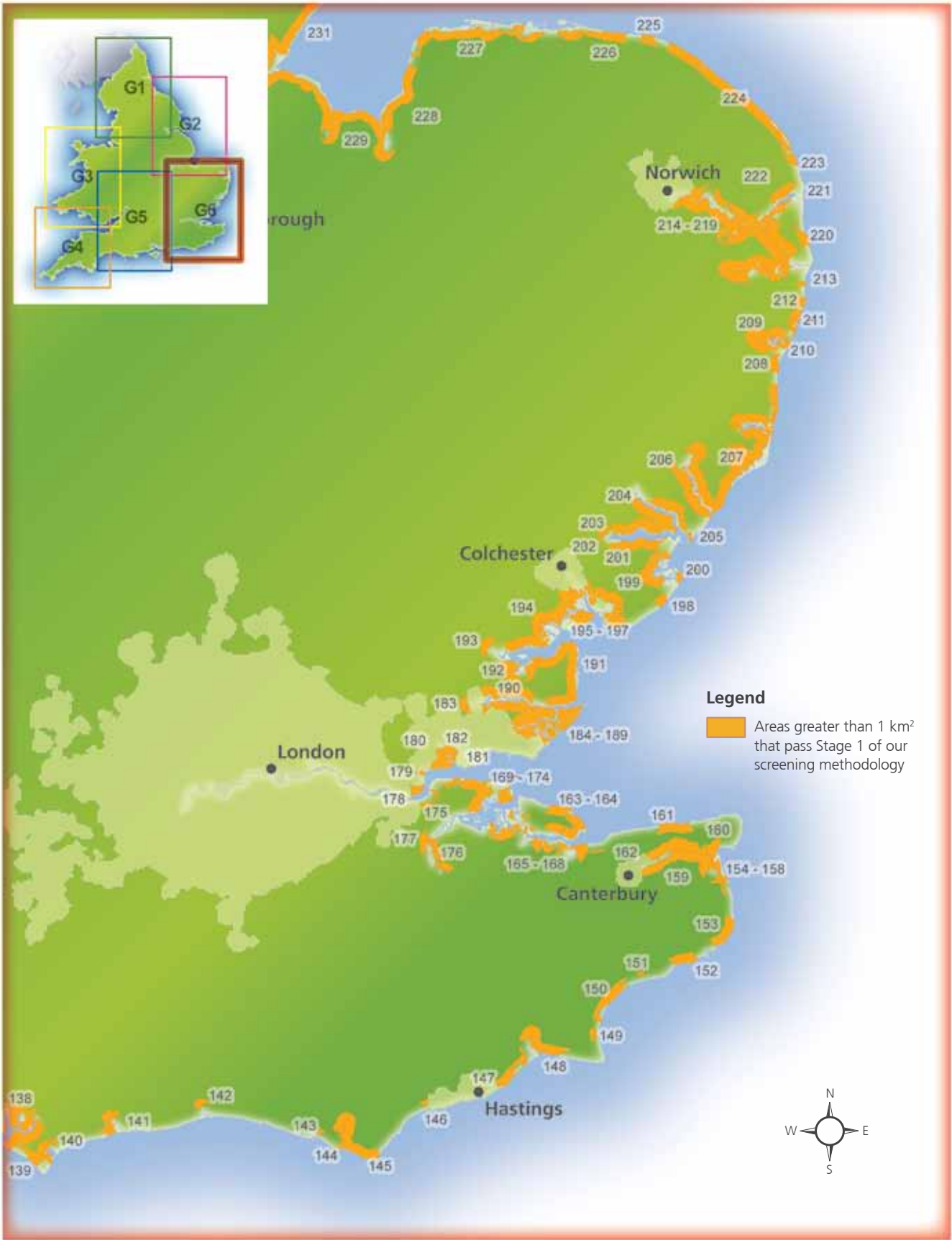
Appendix G4 – South West



Appendix G5 – South Central



Appendix G6 – South East



Appendix G7

Areas between 0.3 km² and 1 km² that were considered to see whether there was sufficient land for 'defence-in-depth' as part of Stage 1 of our methodology



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Appendix H

Sites or areas worthy of further consideration

Druridge Bay and surrounding area



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Scale 1:40,000 @A4

Description of Area

Druridge Bay is a coastal bay in Northumberland, situated around 20 miles to the north of Newcastle.

The shaded areas on the map show the location of sites previously identified in this area by the CEGB in the 1980s as possible sites for new nuclear power stations.

This is a strategic-level study, so any suggestions we make about the boundaries of specific areas should be regarded as approximate and considered further during any subsequent more detailed evaluation. In general terms, the area identified as *worthy of further consideration* runs from Cresswell in the south to Hadston in the north. Beyond these locations are the internationally designated areas of the Northumbrian coast Ramsar and SPA. We have also drawn the boundary to avoid the coastal SSSI Northumberland shore and the area of the shore at higher flood risk.

Assessment of Area

	Technical Factor	Comment
C1	Demographic risk	This entire Area passes the demographic criterion. The part of the Area with the lowest population impact is around the 'Druridge B' site identified by the CEGB in the early 1980s.
C2	Exclusionary military risk	There are no exclusionary military activities within this Area.
D1	Flood risk	<p>Over 90% of the Area is located in Flood Zone 1 (land assessed as having a low flood risk). The remainder – a coastal strip of up to 1 km wide and thin floodplains along the Chevington Burn and an un-named watercourse near Low Hauxley – lies predominantly in Flood Zone 3 (land assessed as being at high flood risk).</p> <p>The sequential approach in PPS25 would guide development away from the higher flood risk coastal strip and river floodplains towards land within Flood Zone 1.</p> <p>The land in Flood Zone 1 is crossed by 5 m and 10 m AOD contours, suggesting that a significant proportion of the Area is located above extreme tide levels – and hence only limited engineering would be needed to protect against extreme events.</p>

	Technical Factor	Comment
D2	Coastal erosion	<p>Druridge Bay is a wide sandy beach backed by dunes which are underlain by till. The maximum width of the dune system along this frontage is 300 m, although over much of the bay it does not exceed 150 m.</p> <p>There are a number of short lengths of hard defence along the frontage, with walls and revetments at Low Hauxley, a short wall at Hadston Carrs and walls at Cresswell. In the Northern part of the Bay, along Hadston Links, there appears to be the remnants of a linear timber structure that has possibly been exposed through erosion of the dune face.</p> <p>This unit appears to have been eroding at its northern end which may be consistent with development towards a zeta bay form (half heart or crenulate shaped bay related to the direction of the most predominant waves). This pattern is disrupted by the Hadston Carrs platform which holds the shoreline forward, although there are erosion problems behind this feature. There is evidence of erosion of the edge of the dunes at several locations in the bay, with the sand probably being reworked onto the beach. The beach width is stable within the bay, and has shown little net movement over the last century. However, the presence of ridge/runnel formations may indicate that there is a reduction in sand volumes in the bay, which may also be implied from the lack of foredunes at the back of the beach. The rock platforms at the north and south ends of the bay are stable.</p> <p>It is likely that the widening and deepening of this bay (evolution of zeta form bay) will continue in the future, with the frontage around Hadston Carrs experiencing the greatest pressure for retreat. At the same time, the switch to a transgressive system (landward retreat of the coastline) is likely to increase the probability of erosion of the dunes throughout the bay in the future. Current dune erosion may be an indication of an overall change in dune development. It is unlikely that sea level rise will cause significant changes in the position or form of the beaches and dunes over the coming century. However the dunes may be vulnerable to breaching during extreme conditions. Snab Point is unlikely to experience any significant change.</p> <p>There are therefore no reasons not to consider the Area further on the basis of coastal erosion risk.</p>
D3	Hazardous facilities	<p>Druridge Bay is located on the Northumberland coastline away from any potentially hazardous facilities. Within a vicinity of 2 km, there is very little development other than two relatively small farms to the west and building ruins to the north west. There are very few hazardous facilities in the region, and all are sufficiently far from the proposed site as to not present a problem. It is not anticipated that there are any hazardous facilities in the area that would prohibit the site from being considered, or developed further.</p>

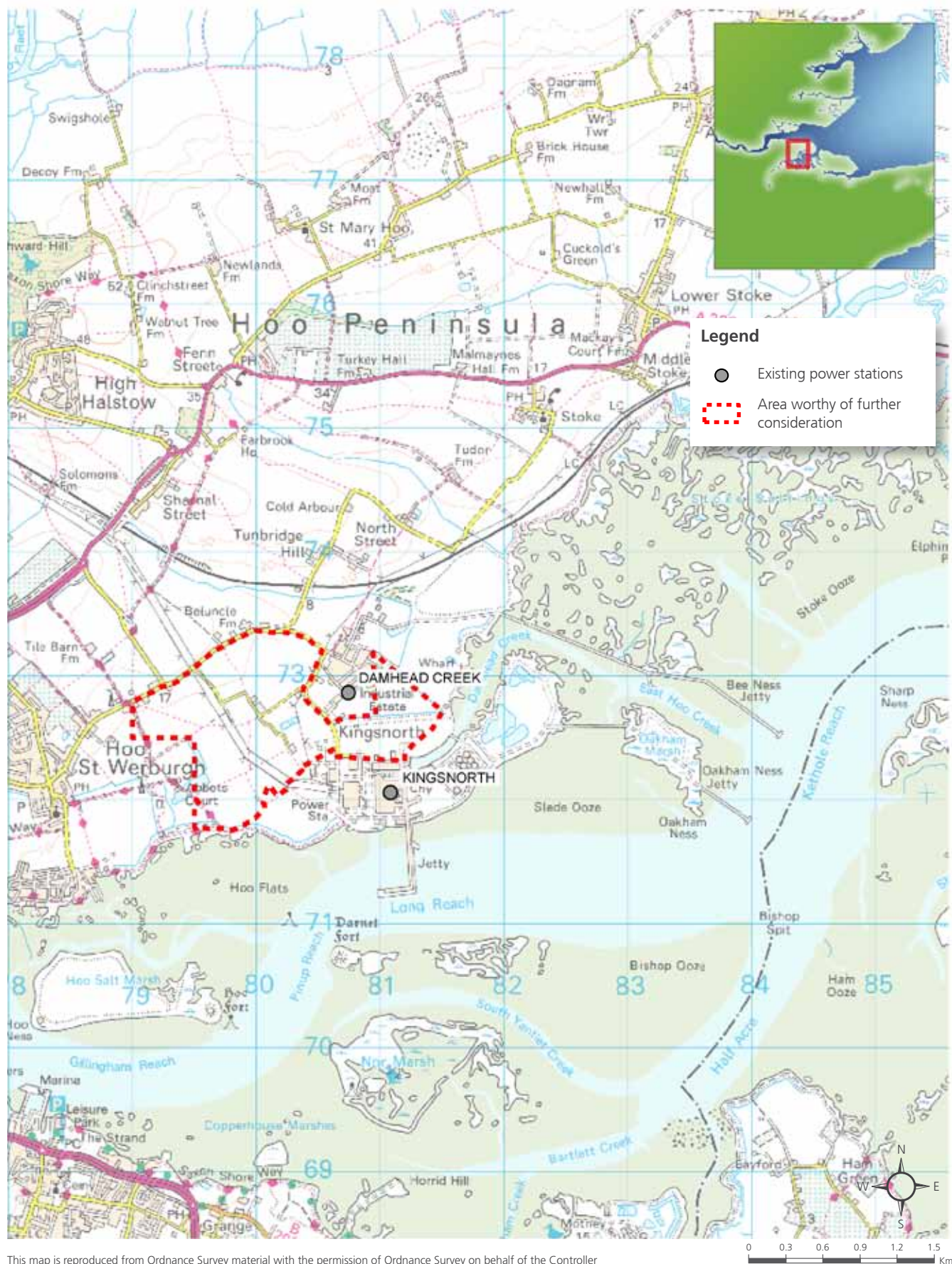
	Technical Factor	Comment
D4	Civil aviation risk	<p>The Area is located on the east coast 20 miles to the north north east of Newcastle International Airport (NIA) and 5.5 miles to the east of Eshott Airfield. It is not located directly beneath any established airways.</p> <p>Newcastle International Airport (NIA) has a single runway orientated 07/25. Flights into and out of NIA would not routinely pass overhead the Area. Any en-route overflight of aircraft routing towards or from NIA would typically take place at altitudes well above any associated Restricted Area that might be established to encompass a nuclear power station.</p> <p>Eshott Airfield (sometimes known as Bockenfield aerodrome) has three asphalt runways: 01/19, 08/26 and 14/32. There is also an associated grass runway parallel to runway 01/19. The runways are short, the longest being 610 m, and the aerodrome can only support general aviation and microlight flying. Some of this traffic may, from time-to-time, fly over the Area. However, the potential damage to a nuclear power station caused by a light aircraft or a microlight is unlikely to be significant and, further, the risk could be partially mitigated by the creation of a flight exclusion zone (Restricted Area), a circle of radius, say, 0.75 nm up to a height of 2,000 ft.</p> <p>In summary, there are unlikely to be any significant aviation problems associated with locating a new nuclear power station within the Area.</p>
D5	Military risk	<p>The Area is located on the east coast some 10 miles south of RAF Boulmer and is not located within a military low-flying area.</p> <p>Flying activity at RAF Boulmer is currently restricted to the operation of A Flight, 202 Squadron. (RAF 202 Squadron operates Sea King HAR Mk 3 helicopters in the Search and Rescue (SAR) role). RAF Boulmer also hosts elements of the Air Surveillance and Control System (ASACS). There is an associated long-range radar located at Brizlee Wood some 8 miles to the west of RAF Boulmer and 15 miles to the north west of Druridge Bay. It is considered unlikely that the construction of a new nuclear power station would affect the operations of 202 Squadron. It is also unlikely that any new nuclear power station would adversely affect transmission and reception at either RAF Boulmer or the associated radar at Brizlee Wood. However, as a precaution, it is recommended that the MOD (RAF) should be consulted at an early stage in the planning process.</p>
D6	Internationally designated sites	<p>The Area, including most of the coast, is not covered by any international ecological designations. However, to the south and north of the Bay, the coast is included within the Northumbria Coast Ramsar Site / SPA. All of the Area lies within 5 km of this designated site, although the central point of the Bay is between 4 and 5 km from the nearest part of the designated site. We believe that direct impacts are not likely, and that indirect impacts could be avoided through an appropriate length of outfall pipe. Although outside the scope of this Study, it should also be noted that studies of other potential indirect impacts, such as effects on birds that may forage or roost outside the SPA, may also be required to support an actual application for development consent.</p>

	Technical Factor	Comment
D7	Nationally designated sites	The inland part of the Area is not covered by any national nature conservation designation. However, the coastal strip forms part of the Northumberland Shore SSSI. Therefore, any development should avoid the shore itself and would need to include a design of intake and outfall culverts that avoids / minimises damage to the designated site. Although outside the scope of this Study, any detailed impact assessment for an actual application for development consent would have to consider indirect impacts as well. Just inland of the coast, towards the south of the bay lies Cresswell Ponds SSSI, and towards the north lies Hadston Links SSSI. These should also be avoided.
D8	Amenity designations	The majority of the Area is clear of amenity designations. There is one Scheduled Ancient Monument (Low Chibburn Medieval Preceptory, 16th Century House and World War II pillbox) in the centre of the Area. From an amenity designation perspective, there is no reason why the site could not be developed if these are avoided or appropriate mitigation is undertaken. The central section of the coastal area of the site is under National Trust ownership.
D9	Size of site	There is sufficient land within the Area to accommodate at least one new nuclear power station. However footpaths and minor roads / tracks may need to be re-sited.
D10	Access to suitable sources of cooling	Although relatively shallow and having a shoreline that is a sensitive area, Druridge Bay could potentially receive a thermal plume from direct cooling. The outfall would therefore probably have to be placed somewhat further offshore into deeper water, equating to a bedlevel of -5 m CD, in order to ensure that the plume length and width were sufficiently constrained to avoid impact with the shoreline. If this is done, there is no reason why a new nuclear power station in the Area would not have access to an appropriate source of cooling.
	Other issues	It is worth noting that the nearest Grid transmission lines to the Area are at Rothbury (14 km away) and Blyth (10 km away).

Summary

The Area around Druridge Bay is *worthy of further consideration*. Although further analysis should be carried out at local level to assess any impacts that there may be to the internationally designated sites to the north and south of the Bay, these are unlikely to be significant and are not sufficient to rule the area out from further consideration in this strategic-level study. The apparent drawback identified in our screening process is a nationally designated area of ecological importance along the shoreline, the impact to which we believe could be mitigated by siting the station a little way back from the coast itself and running the cooling water culverts underneath the shoreline. We note, however, that Druridge Bay is part of the Northumberland Heritage Coast (although not part of the AONB) and part of the land is owned by the National Trust. We also note there is no Grid connection in close proximity, with the nearest Grid transmission lines in excess of 10 km away.

Kingsnorth and surrounding area



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Scale 1:40,000 @A4

Description of Area

This is a strategic-level study, so any suggestions we make about the boundaries of specific areas should be regarded as approximate and considered further during any subsequent more detailed evaluation. In general terms, the Area we are proposing is on land to the north and west of the existing Kingsnorth Power Station up to around 2 km from the existing cooling water intake and outfall. (The intake is on the shoreline, immediately to the south of the existing power station and the cooling water discharges via concrete outlet culverts to a shoreline outfall structure built into the head of Damhead Creek.) The precedent set by the existing power station which has been able to operate in tandem with the adjacent and nearby internationally designated sites (Medway Estuary & Marshes SPA / Ramsar site and Thames Estuary & Marshes SPA / Ramsar site) means development of a similar nature may also be able to operate without adverse impact on these international designations. However, if the existing powerstation continues to operate alongside a proposed new nuclear powerstation, then any assessment would need to include the potential for culmative impacts.

Also included within the Area is the land to the north of the existing Kingsnorth Power Station and to the east of the existing Damhead Creek Power Station for which Section 36 consent has been sought for the construction of a new coal-fired power station and new CCGT power station respectively, although plans for a new coal-fired station have been pushed back until around 2016.²¹ It is clearly the case that should this consent be granted, these areas will be unavailable for consideration for the development of a new nuclear power station. However, in the absence of such consent being granted, we do not believe that these areas can be ruled out as *not worthy of further consideration*.

Existing infrastructure and land use constraints also affect the size and shape of the Area.

The CEEB did express interest in a new nuclear power station at Kingsnorth. However, we do not know what location they envisaged, so we have not included it on the map.

	Technical Factor	Comment
C1	Demographic risk	The entire Area passes the demographic criterion. However, there are significant problems with the development of a site near to areas of high population density. Problems include difficulties in meeting regulators' societal risk targets and in meeting the requirements for emergency planning. The population distribution around Kingsnorth was used to form an initial view of whether extendibility is likely to be a significant issue. The current population beyond 12 km is considered to be sufficiently high that extendibility may present significant difficulties in the event of an emergency. While these are matters for the regulators and the local authority emergency planners to consider when detailed plans for any development are available, it may be that, given these factors, a site so close to a conurbation the size of Greater London and the Medway Towns is not a realistic contender for development by 2025.
C2	Exclusionary military risk	There are no exclusionary military activities within this Area.

²¹ <http://news.bbc.co.uk/1/hi/uk/8296076.stm>

	Technical Factor	Comment
D1	Flood risk	<p>Around 20% of the Area is located in Flood Zone 1 (land assessed as having a low flood risk). The remainder of this Area – the coastal floodplain around the existing Kingsnorth Power Station, lies predominantly within Flood Zone 3 (land assessed as being at high flood risk). Note that flood defences offer protection to the existing conventional Kingsnorth Power Station from tidal flooding.</p> <p>The sequential approach in PPS25 would guide development away from the coastal floodplain around the existing conventional Kingsnorth Power Station towards the land within Flood Zone 1.</p> <p>However, development in Flood Zone 3 adjacent to the existing conventional Kingsnorth Power Station may be possible if application of the Sequential Test could demonstrate that there are no other reasonable available sites appropriate for development of a nuclear power station at a lower flood risk. In addition, compliance with the three elements of the Exception Test would also need to be demonstrated (Paragraph D9 of PPS25) – in particular that development could be made safe from flood risk. We believe that it is reasonable to assume that good engineering practice could reduce flood risk sufficiently to make a new nuclear power station safe in this location.</p>
D2	Coastal erosion	<p>The shoreline is currently fixed by significant defence structures (especially around Kingsnorth Power Station) and is unlikely to show any major change over the next 100 years. Accretion is occurring along the frontage with the establishment of areas of saltmarsh.</p> <p>There are therefore no reasons not to consider the Area further on the basis of coastal erosion risk.</p>
D3	Hazardous facilities	<p>The Area is located approximately 6.5 km from the Isle of Grain. Within a 2 km radius, there is a small village 1 km to the west and marshlands to the east.</p> <p>Kingsnorth is located close to the south east coast of England on the Medway estuary. A dual-fired oil and coal power station is about 500 meters south of the village of Kingsnorth. The site being considered is adjacent to this power station. Hazards from this neighbouring power station are not generally significant, as oil and coal-fired power stations do not release hazardous vapours that are likely to ignite.</p> <p>The Isle of Grain LNG terminal / storage facility is approximately 6.0–6.5 km from the site being considered. The Kingsnorth site is beyond the outer planning zone for the LNG facility which finishes approximately 3 km from the site. It is believed that there is a further development phase of the LNG terminal which could alter the planning zones currently in place. Details of this were not available to this Study.</p> <p>In addition, a GPSS multiproducts pipeline runs from Walton to the Isle of Grain about 5 km from the site. This pipeline is adequately distanced from the proposed site.</p> <p>It is not anticipated that there are any hazardous facilities in the area that would prohibit the site from being considered or developed further.</p>

	Technical Factor	Comment
D4	Civil aviation risk	<p>The Area is located to the south of Ashford, Kent and beneath airspace that is routinely used by aircraft departing from, or positioning to approach Lydd Airport and directly under the northern sector of the Lydd Hold. (Lydd Airport has no dedicated airspace other than an Aerodrome Traffic Zone that extends 2½ nm radius around the aerodrome itself – there is no ‘Lydd control area’.) Lydd Airport has one runway, 03/21, with instrument approaches for runway 21 only. Runway length is currently approximately 1,500 m which restricts the size of aircraft that can operate from the airport. The airport operators have plans to extend the runway but the status of this programme is not known. Lydd operations are currently limited by airspace restrictions to the south west and north east (military ranges) and to the south (Dungeness Nuclear Power Station). There are two smaller, general aviation airfields, one to the east of the Area and one to the west of the Area. Activity at the eastern airfield, Hamilton Farm, appears to be very limited or non-existent. However, the western airfield, Woodchurch, is home to the ‘Woodchurch Warbirds’, a collection of vintage military aircraft. The airfield has in the past held successful air shows and its aircraft appear at air shows throughout the UK.</p> <p>The creation of a 2000 ft exclusion zone (Restricted Area) could restrict activity at both the smaller airfields and further investigation will be needed to determine the impact of these restrictions. The Restricted Area would also create an east-west funnel for Lydd traffic and questions of flight safety arise. The siting of a new nuclear power station under the Lydd Hold (an area of increased air activity) leads to questions of aircraft crash risk and this would need to be assessed. However, the minimum descent height in the Lydd Hold is 3,200 ft so there should not be a direct impact on this aspect of operations.</p>
D5	Military risk	<p>The Area is not in proximity to any Tactical Training Areas or Danger Areas. Part of the area does occupy the statutory safeguarding zone protecting the meteorological radar station at Thurnam and this will need further investigation at a local level.</p>
D6	Internationally designated sites	<p>Medway Estuary & Marshes SPA / Ramsar site surrounds the Area on three sides and is downstream of the Area, so there is a potential mechanism for harm through heat effects, although specialist studies have not been undertaken as part of this Study. Thames Estuary & Marshes SPA / Ramsar site lies downstream to the North.</p> <p>Demonstrating that a new nuclear power station can operate without there being an adverse impact on these international designations may prove challenging, given the cumulative effect of additional cooling water if the existing conventional station remains operational. However, the precedent set by the conventional station (which has been able to exist in tandem with the internationally designated sites including from the perspective of cooling water extraction and discharge) means it may be easier to make the case that a new nuclear power station within this location can operate without an adverse impact.</p> <p>The cooling water intake is on the shoreline, immediately to the south of the existing power station and the cooling water discharge is via concrete outlet culverts to a shoreline outfall structure built into the head of Damhead Creek. There are narrow gaps within the designated site, but assessment has not been undertaken to determine whether intake and outflow pipes could actually be installed there. However, the designated area is also relatively narrow in places, so there may be potential for approaches such as directional drilling to avoid direct damage to the designated site.</p>

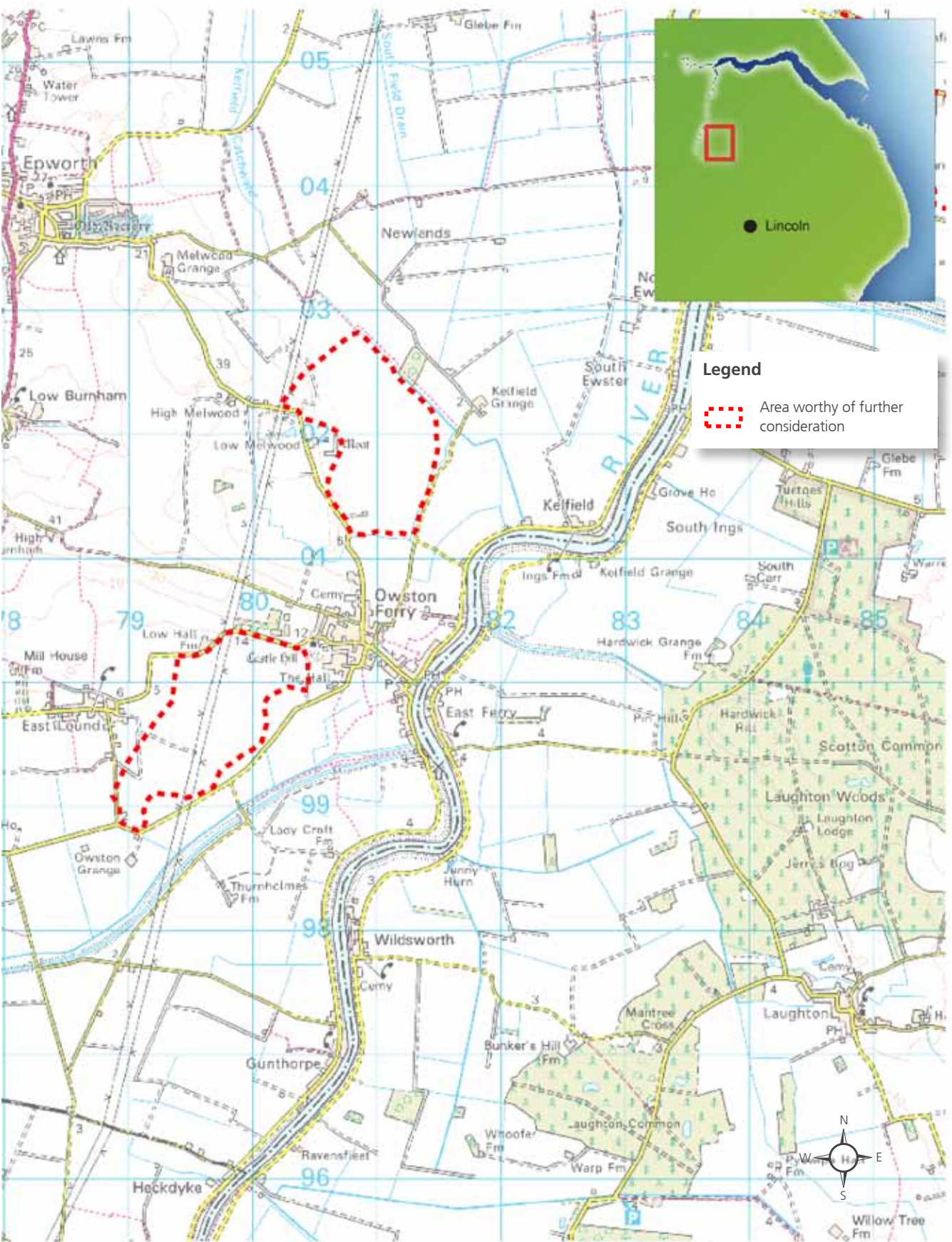
	Technical Factor	Comment
D7	Nationally designated sites	The Area at Kingsnorth is not covered by any designations. A very small section of the southern estuarine edge of the Area is outside any designated site although South Thames Estuary & Marshes and Medway Estuary & Marshes SSSIs bound the remaining edges.
D8	Amenity designations	There are no national amenity designations which would preclude the development of a new nuclear power station within this Area.
D9	Size of site	There is sufficient land within the Area to accommodate at least one new nuclear power station. However footpaths minor roads, tracks and potentially the transmission line may need to be re-sited.
D10	Access to suitable source of cooling	There is sufficient cooling water for at least one new nuclear power station.
	Other issues	It is worth noting that the nearest Grid transmission lines to the Area are less than 1 km away (close to the existing power station).

Summary

The Area close to Kingsnorth Power Station cannot be ruled out as *not worthy of further consideration*. However, while it passes the demographic exclusionary criterion, there may nevertheless be significant problems with the development of a site near to areas of high population density. Problems include difficulties in meeting regulators' societal risk targets and in meeting the requirements for emergency planning. While these are matters for the regulators and the local authority emergency planners to consider when detailed plans for any development are available, it may be that, given these factors, a site so close to a conurbation the size Greater London and the Medway Towns is not a realistic contender for development by 2025.

Demonstrating that a new nuclear power station can operate at Kingsnorth without there being an adverse impact on the Medway Estuary & Marshes SPA / Ramsar site may prove challenging. However, we believe that we cannot rule the Area out as *not worthy of further consideration* on this basis because the existing Kingsnorth Power Station is operating in tandem with these international designations.

Owston Ferry and surrounding area



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0 0.3 0.6 0.9 1.2 1.5 Km

Scale 1:40,000 @A4

Description of Area

This is a strategic-level study, so any suggestions we make about the boundaries of specific areas should be regarded as approximate and considered further during any subsequent more detailed evaluation. In general terms, however, the Area follows the line of the Flood Zone 1 and Flood Zone 2 areas. The sequential approach inherent in PPS25 would guide development towards lower flood risk areas, in preference to other parts of the Lower Trent which are at Flood Zone 3. In addition, we have not included the village of Owston Ferry itself (and the immediate surrounds) and the area behind the village as these areas are ruled out because of the existing land use. We have also excluded the areas around the two Scheduled Ancient Monuments. This leaves two areas – one north and one south of the village – that are in the lower Flood Zones, are away from the village and its immediate surrounds, are away from the Scheduled Ancient Monuments, are within 2 km of the River Trent (as a suitable source of cooling) and are bounded by various roads.

Owston Ferry was identified by the CEGB in the 1980s as a possible site for a new nuclear power station and, our understanding is that, in 1985 it expressed general interest in the site along with other (what it described as) Humberside sites. However, we do not know the precise location that CEGB was considering (if, indeed, its thinking had progressed to such a point) so we cannot take this into account in the above analysis.

Assessment of Area

	Technical Factor	Comment
C1	Demographic risk	The entire Area passes the demographic criterion.
C2	Exclusionary military risk	There are no exclusionary military activities within this Area.
D1	Flood risk	<p>This Area is located in Flood Zones 1 and 2 (land assessed as having low and moderate flood risk). Note flood defences offer protection from flooding from the Trent.</p> <p>Development of a new nuclear power station in this Area may be possible if, as we expect, the application of the Sequential Test could demonstrate that there are no other reasonable available sites appropriate for development at a lower flood risk.</p> <p>In addition, compliance with the three elements of the Exception Test would also need to be demonstrated (Paragraph D9 of PPS25) – in particular that development could be made safe from flood risk. There are issues over whether safe access could be secured during an extreme flood event and whether a new nuclear power station could be built in such a way as to not increase flood risk to others. However, on balance, it is reasonable to assume that good engineering practices could overcome these issues and that flood risk could be managed in a way that would make a new nuclear power station safe in this location.</p>
D2	Coastal erosion	As the site is inland we have considered whether there are any other significant causes of landscape change other than coastal erosion. The primary risk of landscape change is from migration of the river. Assuming current Environment Agency flood defences along each bank of the river are maintained then it is not expected that there will be any natural migration of the river from its current course. Providing that the current strategy is to maintain the standard of protection offered by defences, no significant landscape change is expected over the next 100 years.

	Technical Factor	Comment
D3	Hazardous facilities	<p>Owston Ferry is located on the western side of the River Trent. There are populated areas to the west and north of the prospective site, approximately 5 km away. A TOTAL pipeline running from Buncefield to the Lindsey Oil Refinery in Humberside passes through Lincolnshire. However, it is assumed that its route is almost due north-south, in which case it must pass around 20 km to the east of Owston Ferry. A GPSS pipeline running from Misterton to Lincoln passes around 15 km to the east of the site and another GPSS pipeline running from Misterton to Tattershall runs approximately 5-10 km east of Owston Ferry. Both are multiproduct pipelines operating at a pressure of 725 psi.</p> <p>In addition to the above, a small number of further installations have been identified but all are sufficiently located from the proposed site as to not present a problem.</p> <p>It is not anticipated that there are any hazardous facilities in the area that would prohibit the site from being considered, or developed further.</p>
D4	Civil aviation risk	<p>Owston Ferry lies on the northern edge of the Lincolnshire AIAA. The site is sufficiently far from any large civil airport or military airfield so as not to impinge on any of these activities. However, although siting a new nuclear power station on this stretch of the River Trent causes less impact in terms of air risk than the region further south between Gainsborough and Gunthorpe, anywhere along this portion of the River Trent is likely to be problematic to the light (and military) aviation community. The Restricted Area associated with a new nuclear power station at Owston Ferry would therefore be contained within airspace which is already congested and increasingly restricted. While none of this is sufficient to rule out this stretch of the River Trent as <i>not worthy of further consideration</i>, it is a significant complication that does not need to be addressed at other potential sites.</p> <p>The Area is located to the north east of Doncaster Sheffield (Robin Hood) Airport and some 7 nm to the south east of Sandtoft Airport. Traffic out of Doncaster Sheffield should not be impeded by the creation of an exclusion zone which is outside its Control Zone. None of the instrument approaches or the missed approach paths pass close to the site. However, it would be prudent to include Doncaster Sheffield Airport on the list of consultees.</p> <p>Sandtoft Airfield is located some 7 nm to the north west of the site. The Airfield has only one tarmac runway, 05/23, which has been built on the perimeter track of the original WWII RAF Station Sandtoft. The runway is 886 m x 18 m and suitable for use by a variety of general aviation activity. There is an active flying school based there and the airfield is licensed. The runway orientation is such that normal traffic into and out of Sandtoft should not be affected by the creation of the exclusion zone but the exclusion zone might have some impact on flying training activities. Again, the airfield should be on the list of consultees.</p>
D5	Military risk	<p>The Area identified does not occupy any MOD statutory safeguarding zone and is not in proximity to any Tactical Training Areas or Danger Areas. However, we note that further investigation would be needed at a local level, in consultation with the MOD, to consider the impact of the implementation of an air exclusion area around a new nuclear power station.</p>

	Technical Factor	Comment
D6	Internationally designated sites	Owston Ferry is adjacent to the River Trent. This flows into the Humber Estuary SAC, SPA, Ramsar site. The Area is some 12 km upstream of this international designation. Cooling water would presumably be abstracted from and discharged to the River Trent and detailed studies would be required to analyse and model any impact on designations downstream, particularly heat impacts and any water loss resulting from the abstraction and cooling process. However, at this distance, it seems reasonable to conclude that, from the perspective of international designations, the site is <i>worthy of further consideration</i> .
D7	Nationally designated sites	There are no nationally designated sites within the Area itself. To the west there are two small SSSIs: Rush Furlong and Hewson's Field. These should be avoided.
D8	Amenity designations	<p>There is a significant Scheduled Monument immediately to the west of the boundary of the northern of the two areas (marked 'A' on the map). Adjacent to Low Melwood Farm and Melwood Park is Axholme Carthusian Priory and post-Dissolution garden earthworks. The monument includes the earthworks of a charterhouse (Carthusian Priory) and those related to the houses and gardens built on the site after the Dissolution. It also includes a partly water-filled moat, the buried remains of a Premonstratensian chapel which predates the Priory, and a standing building, now in agricultural use, that incorporates medieval fabric.</p> <p>There is also a significant Scheduled Monument immediately to the east of the southern of the two areas, on the south west side of Owston Ferry (marked 'B' on the map). This is Kinaird motte and bailey castle. The monument includes part of the buried and earthwork remains of a Norman earthwork castle.</p> <p>The effect of a Scheduled Monument designation is effectively to prevent all but nationally significant development on the site of the Scheduled Monument itself. However, development adjacent to these Scheduled Monuments is more likely to be acceptable, particularly if the Scheduled Monuments are to be left in situ and are not directly affected. Depending on the distance of the proposed development from the Scheduled Monument, stringent conditions may be attached to any Scheduled Monument Consent and/or planning permission in order to ensure protection and, where appropriate, recording, either to record possible damage, or to make a historical record of the Scheduled Monument.</p>
D9	Size of site	There is sufficient land in both parts of the Area to accommodate at least one new nuclear power station. In the southern area, a few small tracks and the transmission lines may need to be re-sited.
D10	Access to suitable source of cooling	There is sufficient cooling water for at least one new nuclear power station within the Area.

	Technical Factor	Comment
	Other issues	<p>It is worth noting that Grid transmission lines run through the southern of the two areas (marked 'B'), and are less than 1 km from the northern of the two areas (marked 'A').</p> <p>Although transportation issues are not among the SSA Criteria, there are two transport-related factors that may make it difficult for the Area to be developed by 2025. First, the development of new nuclear power stations requires very large components (such as pressure vessels) for which road or rail is often impossible. The fact that the Area is set back by some distance from the River Trent may also make any intended use of the river for transport problematic. Secondly, the roads in the Area are particularly narrow and the development of an acceptable transportation plan (to include personnel and materials) is likely to be challenging without significant investment and/or changing the character of the surrounding area.</p>

Summary

The Area around Owston Ferry cannot be ruled out as *not worthy of further consideration* but we believe there are drawbacks inherent in river-based sites that may make them unattractive from the perspective of development. For example the use of river water for cooling may lead to reduced thermal efficiency that (while we have explicitly excluded economic factors from our Study) could result in lower power generation and thus a significant loss in revenue, and there may be a susceptibility to reduced operations during drought. There is also an absence of any precedent for river-based nuclear power stations in the UK. Furthermore, while significantly less of an issue than further upstream on the Trent, siting a new nuclear power station at either of these sites would be likely to be problematic to the light aviation (and military aviation) community. It may be that, given these factors, this Area is not a realistic contender for development by 2025. Furthermore, we note that all 11 sites nominated as part of the SSA process are coastal locations and, in our discussions with energy companies about river-based sites, some ruled out their development completely and even the most positive regarded them as a low priority (although not totally ruled out in the longer term).

Abbreviations

Abbreviations

AIAA	Area of Intense Air Activity
AONB	Area of Outstanding National Beauty
ASACS	Air Surveillance and Control System
BERR	Department for Business, Enterprise and Regulatory Reform
BNFL	British Nuclear Fuels Limited
CCGT	Combine Cycle Gas Turbines
CD	Chart Datum
CEGB	Central Electricity Generating Board
(CEGB) HSD	(CEGB) Health and Safety Department
DECC	Department of Energy and Climate Change
DTI	Department of Trade and Industry
EA	Environment Agency
GIS	Geographic Information System
HRA	Habitats Regulations Assessment
HSL	Health and Safety Laboratory
ICE	Institution of Civil Engineers
LNG	Liquefied Natural Gas
MOD	Ministry of Defence
MW	Megawatts
NDA	Nuclear Decommissioning Authority
NII	Nuclear Installations Inspectorate
NPS	National Policy Statement
OCNS	Office for Civil Nuclear Security
PADHI	Planning Advice for Developments near Hazardous Installations
PPS	Planning Policy Statement
PWR	Pressurised Water Reactor
RAF	Royal Air Force
SAC	Special Areas of Conservation
SAM	Scheduled Ancient Monument
SAP	Safety Assessment Principles
SAR	Search and Rescue
SPA	Special Protection Areas
SSA	Strategic Siting Assessment
TAN	Technical Advice Note
UKAEA	United Kingdom Atomic Energy Authority



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