

**Lower Thames Crossing
6.3 Environmental Assessment
Appendices
Appendix 11.2 – Mineral
Safeguarding Assessment**

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Lower Thames Crossing

Appendix 11.2 – Mineral Safeguarding Assessment

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1 Executive summary

- 1.1.1 This document provides an assessment of the mineral resources within the Order Limits and has been prepared to determine if the Project would lead to adverse effects and potential sterilisation of mineral units which have been designated as safeguarded from non-mineral development by the Minerals Planning Authority.
- 1.1.2 Mineral Safeguarding Areas (MSAs) identify where resources are located to make relevant parties aware of their presence and ensure that they are considered when determining the acceptability of planning applications, so that these resources are not needlessly sterilised. The identification of an MSA carries no presumption for extraction and there is no presumption that any areas within an MSA will ultimately be acceptable for mineral extraction.
- 1.1.3 The National Networks National Policy Statement (NPSNN) sets out the Government's policies to deliver Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The NPSNN (Department for Transport, 2014) states that, '*Applicants should safeguard any mineral resources on the proposed site as far as possible*' (paragraph 5.169). The NPSNN also states, '*Where a proposed development has an impact on a Mineral Safeguarding Area (MSA), the Secretary of State should ensure that the applicant has put forward appropriate mitigation measures to safeguard mineral resources*' (paragraph 5.182).
- 1.1.4 For ease of reporting and identifying potential effects, this assessment has been split into four segments covering the relevant Mineral Planning Authorities from south to north:
- a. Segment 1: Kent County Council, also incorporating minerals in Maidstone Borough Council, Tonbridge and Malling Borough Council and Gravesham Borough Council.
 - b. Segment 2: Thurrock Council (as a unitary authority)
 - c. Segment 3: Essex County Council, incorporating minerals in Brentwood Borough Council
 - d. Segment 4: London Borough of Havering
- 1.1.5 The mineral safeguarding assessment has been undertaken in three stages:
- a. Stage 1 – scope definition and engagement
 - b. Stage 2 – mineral study baseline
 - c. Stage 3 – mineral safeguarding impact assessment

- 1.1.6 A review of the applicable minerals policy documents was undertaken to identify safeguarded mineral workings, infrastructure, preferred and/or reserved extraction sites and mineral safeguarding areas (MSAs). Policy documents reviewed were:
- a. Kent Minerals and Waste Local Plan 2013-2020 – also covering Maidstone, Tonbridge and Malling and Gravesham
 - b. Essex Minerals Local Plan, adopted 2014, also covering Brentwood and adopted by Thurrock
 - c. London Borough of Havering Local Plan 2016-2031
- 1.1.7 Consultation has been undertaken with the relevant Mineral Planning Authorities. Consultations were held with Kent, Essex and Havering in order to obtain their views on the likely safeguarded mineral resources within the Order Limits and to focus the assessment on the areas of interest for each local authority.
- 1.1.8 The minerals baseline was characterised using the adopted policy, technical engagement with the mineral authorities, minerals information by the British Geological Survey and Project ground investigation.
- 1.1.9 In line with the identified minerals policy, a desk study review of existing constraints to potential mineral extraction was undertaken for each Segment to help inform the level of potential sterilisation as a result of the Project.
- 1.1.10 Land acquired temporarily as part of the construction was not considered as temporary working areas would be reinstated following completion of the works on the land and any underlying minerals could be accessed in the future. The Project design has been optimised to minimise the land required to construct and operate the Project and maximise the land reinstated and returned to owners. Where land is returned, the Project would not result in the permanent sterilisation of underlying mineral resource.
- 1.1.11 Where avoidance of safeguarded mineral units has not been possible and in line with Paragraph 5.182 of the NPSNN, the Applicant has sought to identify appropriate mitigation measures. These measures prioritise the prior extraction and reuse, recycling and recovery of materials excavated as part of the construction works within the Project design (for example, as engineering and landscape filling, embankment construction). Measures have been included within the Register of Environmental Actions and Commitments (REAC) which forms part of Appendix 2.2 of the Code of Construction Practice (Application Document 6.3). Each entry in the REAC has an alpha-numerical reference code (e.g. MW0XX) to provide cross reference to the secured commitment. Mitigation in relation to minerals is presented in Section 5.3 of this report.
- 1.1.12 A summary of the Project's potential impact on minerals is presented in Section 6. Following the application of any appropriate mitigation measures, a conclusion is reached regarding the potential for sterilisation of mineral resources within the area of land subject to permanent acquisition.

2 Introduction

2.1 Purpose of this document

- 2.1.1 National Highways (the Applicant) has submitted an application under Section 37 of the Planning Act 2008 for a Development Consent Order (DCO) for the A122 Lower Thames Crossing (the Project).
- 2.1.2 This document provides an assessment of the mineral resources within the Order Limits. It does not provide an indication of the intended management of any identified mineral resources by National Highways during construction.

2.2 The Project

- 2.2.1 The Project would provide a connection between the A2 and M2 in Kent, east of Gravesend, crossing under the River Thames through two bored tunnels, before joining the M25 south of junction 29.
- 2.2.2 The A122 road would be approximately 23km long, 4.25km of which would be in tunnel. On the south side of the River Thames, the Project route would link the tunnel to the A2 and M2. On the north side, it would link to the A13 and junction 29 of the M25. The tunnel portals would be located to the east of the village of Chalk on the south of the River Thames and to the west of East Tilbury on the north side. Plate 2.1 shows the Lower Thames Crossing route.
- 2.2.3 Junctions are proposed at the following locations:
- New junction with the A2 to the south-east of Gravesend
 - Modified junction with the A13/A1089 in Thurrock
 - New junction with the M25 between junctions 29 and 30
- 2.2.4 The Project road would be three lanes in both directions, except for:
- link roads
 - stretches of the carriageway through junctions
 - the southbound carriageway from the M25 to the junction with the A13/A1089, which would be two lanes
- 2.2.5 In common with other A-roads, the A122 would operate with no hard shoulder but would feature a 1m hard strip on either side of the carriageway. It would also feature technology including stopped vehicle and incident detection, lane control, variable speed limits and electronic signage and signalling. The A122 road design outside the tunnel includes emergency areas spaced at intervals between 800 metres and 1.6km. The tunnel would include a range of enhanced systems and response measures instead of emergency areas.
- 2.2.6 The A122 would be classified as an ‘all-purpose trunk road’ with green signs. For the benefit of safety, walkers, cyclists, horse riders and slow-moving vehicles would be prohibited from using it.

- 2.2.7 The Project would include adjustment to a number of side roads. There would also be changes to a number of public rights of way, used by walkers, cyclists and horse riders. Construction of the Project would also require the installation and diversion of a number of utilities. This includes complex diversions of high-pressure gas pipelines, and relocation of overhead power lines and associated pylons. Other utilities requiring diversion includes underground electricity cables, as well as water supplies and telecommunications assets and associated infrastructure.
- 2.2.8 The Project has been developed to avoid or minimise significant effects on the environment. The proposed measures include landscaping, noise mitigation, green bridges, floodplain compensation, new areas of ecological habitat and two new parks.

Plate 2.1 Lower Thames Crossing route



2.3 Structure of this document

- 2.3.1 National Highways has undertaken a Mineral Safeguarding Assessment for the Project. This assessment is required to determine if the Project would lead to adverse effects and potential sterilisation of mineral units which have been designated as safeguarded from non-mineral development by the Minerals Planning Authority.
- 2.3.2 The National Planning Policy Framework describes Mineral Safeguarding Areas (MSAs) as '*[areas] designated by Mineral Planning Authorities which covers known deposits of minerals which are desired to be kept safeguarded from unnecessary sterilisation by non-mineral development*' (Ministry of Housing Communities and Local Government (MHCLG), 2021).
- 2.3.3 The boundaries of the relevant authorities are presented on each of the figures supporting this assessment. For ease of reporting and identifying potential effects, the study has been split into four Segments covering the relevant Mineral Planning Authorities from south to north:
- a. Segment 1: Kent County Council, herein referred as Kent throughout, also incorporating minerals in Maidstone Borough Council (Maidstone), Tonbridge and Malling Borough Council (Tonbridge and Malling) and Gravesham Borough Council (Gravesham).
 - b. Segment 2: Thurrock Council (as a unitary authority), herein referred as Thurrock throughout
 - c. Segment 3: Essex County Council, herein referred as Essex throughout, incorporating minerals in Brentwood Borough Council (Brentwood)
 - d. Segment 4: London Borough of Havering, herein referred as Havering throughout
- 2.3.4 The Order Limits do not extend into Medway Council's unitary authority area.
- 2.3.5 No land subject to permanent acquisition is proposed in areas for which Medway Council is the relevant local authority and the areas directly adjacent to the Order Limits in Medway have already been developed for housing. Therefore, no potential adverse effects on mineral reserves in Medway would occur. Medway was not, therefore, contacted during the preparation of this report.
- 2.3.6 This report provides a description of the likely safeguarded mineral resources within the Order Limits.
- 2.3.7 The Mineral Safeguarding Assessment has been undertaken in three stages:
- a. **Stage 1 – scope definition and engagement.** This stage comprised initiating communication with the relevant authorities to obtain their opinion on the likely mineral safeguarded resource areas and whether they considered certain areas of identified minerals to be of value or without need for protection. Reference has been made to the various guidance documents provided by the local authorities and other institutions (e.g.

British Geological Survey (BGS) mapping and borehole logs), as well as the National Policy Statement for National Networks (NPSNN) (Department for Transport, 2014) and the National Planning Policy Framework (MHCLG, 2021). Discussions were held with the local authorities to define their areas of interest pertinent to the sections of the Project within their administrative area.

- b. **Stage 2 – mineral study baseline.** Following Stage 1 and agreement with the local authorities on the study area, a detailed desk-study review of the relevant guidance documents and geological information was carried out, alongside Project development ground investigation data, to understand the existing extent of strategic mineral extraction sites, minerals infrastructure and any likely safeguarded mineral resources within the study area. The data reviewed included geological mapping, available historical borehole logs and reports, and information obtained from the local authorities. This information was then used to map out the potential areas of the safeguarded minerals as presented in Figure 1. In addition, a desk study was carried out to investigate potential constraints to mineral extraction that currently exist within the Order Limits. These are described further in Section 4.6.
- c. **Stage 3 – mineral safeguarding impact assessment.** The key purpose of this exercise was to determine if the Project would adversely affect the mineral resource capacity within the defined MSA designated by the mineral's authority. This stage of work provided an area (m²) of the predicted effect on mineral resources located within the extent of permanent land acquisition, taking account of the minerals study baseline and existing constraints within the Order Limits. Land subject to temporary possession as part of the construction of the Project was not considered in the assessment. The temporary areas would be reinstated following completion of the works on the land and any underlying minerals would not therefore be subject to permanent sterilisation.

2.4 Limitations and expectations

- 2.4.1 This report is based on information available at the time of preparation, including local authority and county council mineral policies and Project ground investigation data to validate the desk study.
- 2.4.2 A review of the Project ground investigation data has been completed to validate the findings of the desk data and conforms with the existing understanding of mineral resources located within the Lower Thames Estuary area.

3 Policy Review and Consultation with Local Authorities (Stage 1)

3.1 Introduction

- 3.1.1 Minerals safeguarding is the process of ensuring that non-minerals development does not needlessly prevent the future extraction of mineral resources of local and national importance.
- 3.1.2 In order to avoid the sterilisation of mineral resources by other forms of development, it is the duty of Mineral Planning Authorities to safeguard mineral sites, allocated mineral reserves and mineral resources. This duty is incorporated into a number of planning policy documents, which are explained further in Section 3.5.
- 3.1.3 To achieve this goal, Mineral Planning Authorities designate strategic sites as preferred and/or reserve mineral sites for extraction within their spatial development plans, identifying sites where the principle of extraction has been accepted and the need for the release of minerals is proven. These sites, alongside existing extraction and minerals infrastructure, are key to the mineral planning authority achieving its plan aims.
- 3.1.4 Mineral Safeguarding Areas (MSAs) identify where resources are located to make relevant parties aware of the presence of the resources and ensure that their presence is considered when determining the acceptability of planning applications, so that these resources are not needlessly sterilised. The identification of an MSA carries no presumption for extraction and there is no presumption that any areas within an MSA will ultimately be acceptable for mineral extraction.
- 3.1.5 MSAs have been designated by mineral authorities to protect potential mineral resources from sterilisation caused by incompatible developments. An incompatible development is defined as development which prevents future extraction and an unacceptable diminishment of the mineral resources in that area.
- 3.1.6 An analysis of the applicable policy for each mineral planning authority and the National Planning Policy Framework is detailed below. A more detailed description of the likely presence and extent of economic minerals present is provided in Section 4.

3.2 Need for the Project

- 3.2.1 A full description of the need for the scheme is presented in Application Document 7.1.
- 3.2.2 The NPSNN (Department for Transport, 2014), Road Investment Strategy 1 (DfT, 2015) and Road Investment Strategy 2 (DfT, 2020) provide strong and clear support for delivering national networks that meet the UK's long-term needs. Chapter 3 of the Need for the Project (Application Document 7.1) establishes the need for the Project to deal with long-standing transportation, economic and community and environmental problems caused by the lack of alternative river crossings to the Dartford Crossing in the south-east of England.

- 3.2.3 The current operational challenges at the Dartford Crossing have significant negative impacts on users and non-users in terms of economic productivity and trade, social and user experience and environmental impacts.
- 3.2.4 Congestion and incidents at the Dartford Crossing cause slow and unreliable journeys for a high number of vehicles for long periods every day. This has severe economic, safety and environmental impacts, significantly affecting users and local communities. Therefore, the need for the Project is in the public interest.
- 3.2.5 The Project could have transformational and significant positive impacts on the future growth potential of the national and regional economies and the prosperity of the local population now and into the future. Without additional road capacity, the transport, economic and environmental problems would continue to worsen over time.
- 3.2.6 The consequences of not proceeding with a new crossing are as follows:
- a. Congestion and delays would likely worsen both at the Dartford Crossing and on the local road network; journey times would increase and journeys would be less reliable.
 - b. National, regional and local productivity and economic growth would be constrained and the cost of moving freight by road would increase.
 - c. There is expected to be a further deterioration of safety on the roads close to the Dartford Crossing.
 - d. Increases in road traffic would likely increase congestion, noise and vehicle emissions in an area which already exceeds acceptable levels.
- 3.2.7 The Project would significantly contribute to resolve these issues and deliver benefits across a wide range of needs and opportunities. This demonstrates a clear and compelling need for the Project.
- 3.2.8 An additional crossing of the River Thames, east of London, would provide more reliable journeys across the River Thames. The enhanced connectivity would provide increased cross-river economic opportunities, which would stimulate competition and boost employment in the region. It would also allow for quicker, more reliable access to key markets, resources and labour for the region's ports.
- 3.2.9 The Project would provide enhanced connectivity and facilities for walkers, cyclists and horse riders, alongside improved access to community and businesses. Additionally, reduced congestion in the Dartford area would decrease air pollution and noise.
- 3.2.10 As a result of the Project, journeys on both sides of the river, as well as those that cross the river, would be quicker, and these journeys would be subject to less frequent delays and uncertainty that is currently experienced. Congestion at the Dartford Crossing would be significantly reduced as the Project would provide substantial additional capacity and a new route option across the River Thames.

- 3.2.11 The benefits of the Project are also considered against relevant policies within the Planning Statement (Application Document 7.2). For the reasons set out above, it is submitted that there is a clear and overriding need for the Project, the adverse effects of which are outweighed by the benefits.

3.3 Alternatives

- 3.3.1 Chapter 3 of the Planning Statement (Application 7.2) provides a comprehensive description of the reasonable alternatives considered during the development of the A122 Lower Thames Crossing. The option identification and selection process that has led to the development of the preferred route has been subject to careful review. Each of the decisions was reviewed, both in 2018 and in 2020, accounting for changes to local development plans, new understandings of traffic movements, and the design changes that had emerged through the development of the Project. It has been determined that the findings of the option identification and selection process remain valid and alternative route option locations would not meet the Scheme Objectives and are not viable. The route presented in this application remains the best solution for the Project.

3.4 National Planning Policy

National Planning Policy Framework

- 3.4.1 The national basis for the development of local planning policies prepared by local authorities is the National Planning Policy Framework (NPPF) (MHCLG, 2021). This document includes guidance for local authorities on protecting their mineral resources (p. 59). A key feature of the National Planning Policy Framework is the production of MSAs so that mineral resources are not needlessly sterilised. An MSA is '*an area designated by Mineral Planning Authorities which covers known deposits of minerals which are desired to be kept safeguarded from unnecessary sterilisation by non-mineral development*' (MHCLG, 2021).
- 3.4.2 Paragraph 210 (c) of the NPPF confirms that MSAs do not create a presumption that the resources defined would be worked.

National Policy Statement for National Networks

- 3.4.3 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver Nationally Significant Infrastructure Projects (NSIP) on the national road and rail networks in England. The Secretary of State uses the NNNPS as the primary basis for making decisions on Development Consent Order applications within its scope.
- 3.4.4 The NPSNN (Department for Transport, 2014) states that, '*Applicants should safeguard any mineral resources on the proposed site as far as possible*' (paragraph 5.169). The NPSNN also states, '*Where a proposed development has an impact on a Mineral Safeguarding Area (MSA), the Secretary of State should ensure that the applicant has put forward appropriate mitigation measures to safeguard mineral resources*' (paragraph 5.182).

3.5 Local authority applicable minerals policy and stakeholder engagement

- 3.5.1 The following sections review the relevant local authorities’ policies regarding mineral safeguarding. It also details the consultation that has been undertaken with the relevant Mineral Planning Authorities. Consultations were held with Kent, Essex and Havering in order to obtain their views on the likely mineral safeguarded resource areas within the Order Limits and to focus the assessment on the areas of interest for each local authority.
- 3.5.2 Consultations with Brentwood, Maidstone, Tonbridge and Malling and Gravesham were not undertaken because these councils fall under the mineral planning authority of Essex County Council and Kent County Council respectively. Although Thurrock currently has no formal mineral safeguarding policy, consultation was completed as described in Chapter 11: Material Assets and Waste (Application Document 6.1). A summary of consultations is presented below.
- 3.5.3 The Order Limits do not extend into Medway Council’s unitary authority area. No permanent acquisition is proposed in relation to land for which Medway Council is the relevant local authority and the areas directly adjacent to the Order Limits in Medway have already been developed for housing. Therefore, no potential adverse effects on mineral reserves in Medway would occur. Medway was not, therefore, contacted during the preparation of this report.
- 3.5.4 The mineral safeguarding assessment which supported the withdrawn DCO application was shared with the Mineral Planning Authorities in November 2020.

Segment 1: Kent

- 3.5.5 The Order Limits south of the River Thames are located entirely within the administrative area of Kent, but also includes the borough councils of Maidstone, Tonbridge and Malling and Gravesham. For their minerals policy, Maidstone, Tonbridge and Malling, and Gravesham defer to the Kent Minerals and Waste Local Plan 2013-2030 (Kent County Council, 2020).
- 3.5.6 The Kent Minerals and Waste Local Plan includes:
- a. Core Strategy Minerals (CSM) Policies, which set out the delivery strategy for minerals.
 - b. Development management policies (DM) that will be used when the County Council makes decisions on planning applications.
- 3.5.7 Table 3.1 presents policies of relevance to the mineral safeguarding assessment for Kent:

Table 3.1 Spatial policies identified within the Kent Minerals and Waste Local Plan 2013-2030

Policy	Description	Relevance
CSM 2	Supply of land-won minerals in Kent	Allocation of strategic mineral extraction sites for provision of minerals in Kent.

Policy	Description	Relevance
		Three sites are identified in the plan. None of the allocated sites are located within the Order Limits.
CSM 3	Strategic site for minerals	Medway cement works are safeguarded from non-compatible development. The Project would not impact the existing or future expansion of this site.
CSM 5	Land-won mineral safeguarding	Prevention of the sterilisation of economic minerals by incompatible development. Economic minerals were identified within the Order Limits and are discussed further and in the Minerals Baseline Section 4.2.
CSM 6	Safeguarded wharves and rail depots	Sixteen sites are safeguarded in the plan. None of the safeguarded mineral infrastructure sites are located within the Order Limits.

- 3.5.8 No allocated mineral sites were identified in relation to Policies CSM 2, CSM 3 or CSM 6 within the study area. No further assessment of impacts on allocated mineral sites and infrastructure in Kent was taken forward to Stage 2 and Stage 3.
- 3.5.9 In relation to CSM 5, a review of the MSAs presented within the Kent Minerals and Waste Local Plan has confirmed that there are no safeguarded minerals located within the Order Limits in Maidstone and Tonbridge and Malling (Tonbridge and Malling Borough Council – Mineral Safeguarding Area map and Maidstone Borough Council – Mineral Safeguarding Areas map (Kent County Council, 2020))
- 3.5.10 The Order Limits cross an MSA in Gravesham Borough Council. The Gravesham Borough Council - Mineral Safeguarding Areas map shows that the MSAs comprise River Terrace Deposits and sub-Alluvial River Terrace Deposits and are located adjacent to Lower Higham Road and north towards the River Thames.
- 3.5.11 The following Development Management policies were noted in relation to CSM 5.
- 3.5.12 Kent Policy DM 7 (Safeguarding Mineral Resources) states:
'Planning permission will only be granted for a non-mineral development that is incompatible with minerals safeguarding, where it is demonstrated that either:
- a. the mineral is not of economic value or does not exist; or*
 - b. that extraction of the mineral would not be viable or practicable; or*
 - c. the mineral can be extracted satisfactorily, having regard to Policy DM9 [Prior Extraction of Minerals in Advance of Surface Development], prior to the non-minerals development taking place without adversely affecting the viability or deliverability of the non-minerals development; or*
 - d. the incompatible development is of a temporary nature that can be completed and the site returned to a condition that does not prevent mineral extraction within the timescale that the mineral is likely to be needed; or*

- e. *material considerations indicate that the need for the development overrides the presumption for mineral safeguarding such that sterilisation of the mineral can be permitted following the exploration of opportunities for prior extraction; or*
- f. *it constitutes development that is exempt from mineral safeguarding policy, namely householder applications, infill development of a minor nature in existing built-up areas, advertisement applications, reserved matters applications, minor extensions and changes of use of buildings, minor works, non-material amendments to current planning permissions; or*
- g. *it constitutes development on a site allocated in the adopted development plan where consideration of the above factors (1-6) concluded that mineral resources will not be needlessly sterilised.'*

3.5.13 Kent Policy DM 9 (Prior Extraction of Minerals in Advance of Surface Development) states:

'Planning permission for, or incorporating, mineral extraction in advance of development will be granted where the resources would otherwise be permanently sterilised provided that:

- a. *the mineral extraction operations are only for a temporary period; and*
- b. *the proposal will not cause unacceptable adverse impacts to the environment or communities.'*

3.5.14 Kent Policy DM 2 (Environmental and Landscape Sites of International, National and Local Importance) of the Kent Minerals and Waste Local Plan states:

'Proposals for minerals and/or waste development will be required to ensure that there is no unacceptable adverse impact on the integrity, character, appearance and function, biodiversity interests, or geological interests of sites of international, national and local importance.'

a. International sites

Minerals and/or proposals located within or considered likely to have any significant effect on international designated sites, including Ramsar, Special Protection Areas and Special Areas of Conservation (European Sites), will need to be evaluated in combination with other projects and plans. Before any such proposal will be granted planning permission or identified in the Minerals and Waste Site Plans, it will need to be demonstrated that:

- a. *there are no alternatives*
- b. *there is a robust case established as to why there are imperative reasons of overriding public interest*
- c. *there is sufficient provision for adequate and timely compensation.'*

- 3.5.15 A meeting was held with Kent County Council on 27 July 2018 to identify the council's specific requirements for mineral safeguarding and to address queries regarding mineral extraction within the Order Limits. During the meeting, the following key points were raised:
- Details were provided on mineral deposits in the area, including the gravel around and adjacent to the Thames Estuary and Marshes Ramsar site. Safeguarded minerals were confirmed as River Terrace Deposits and sub-Alluvial River Terrace Deposits shown on the Kent Minerals and Waste Local Plan. These are located adjacent to Lower Higham Road and north towards the River Thames (Gravesham Borough Council – Mineral Safeguarding Areas map (Kent County Council, 2020).
 - There was confirmation that policy Development Management (DM) 7 (and other applicable policies as noted in Section 3.33.3) of the Kent Minerals and Waste Local Plan would need to be satisfied.
 - Kent County Council advised they were unlikely to support prior surface extraction of safeguarded resources which comprise the sub-Alluvial River Terrace Deposits and the River Terrace Deposits (as shown on the Gravesham Borough Council Mineral Safeguarding Areas map) within and adjacent to the Thames Estuary and Marshes Special Protection Area and Ramsar site.
 - The potential for reuse of any resources extracted during construction, either as source materials for the Project construction or for onward sale, was discussed.
- 3.5.16 The key concern raised during consultation was that Kent County Council would be unlikely to support prior mineral extraction in or adjacent to the Thames Estuary and Marshes Special Protection Area and Ramsar site and the South Thames Estuary and Marshes Site of Special Scientific Interest (which stretches along the River Thames) due to the potential for negative impacts on the internationally designated wetland.
- 3.5.17 Kent County Council expressed concern during the 27 July 2018 meeting about the groundwater linkage between the River Terrace Deposits and the Thames Estuary and Marshes Special Protection Area and Ramsar site, should mineral extraction occur in this resource. The concern was that any extraction and water control measures would be a constraint and cause an adverse impact on the Ramsar site by unacceptably reducing the water levels within the Ramsar site and the surrounding area.

Segment 2: Thurrock

- 3.5.18 Most of the Project to the north of the River Thames is located within Thurrock. Thurrock is located within the county of Essex and is a unitary authority area, giving Thurrock responsibility over mineral matters and designating MSAs. Thurrock extends from the north bank of the River Thames to its border with Havering and lies between North and South Ockendon.

- 3.5.19 A review of the Thurrock Core Strategy and Policies for Management of Development (as amended) (Thurrock Council, 2015) was completed, which identified two policies related to minerals: CSTP31 (Provision of Minerals) and CSTP32 (Safeguarding Minerals Resources). Although the policies set out the approach for safeguarding mineral resources and facilities, the core strategy does not provide the details of any MSAs or strategically allocated sites for mineral extraction and mineral infrastructure, but rather states that these would be defined in the forthcoming local plan, which has yet to be published.
- 3.5.20 For the purpose of this document, it was confirmed via information provided on Thurrock’s website (<https://www.thurrock.gov.uk/core-strategy-local-plan/minerals-and-waste>) that the council relies on the Essex Minerals Local Plan (Essex County Council, 2014) for its mineral policy, and therefore the policy measures described for Essex (below) have been adopted for the areas of the Order Limits which fall within Thurrock’s administrative area.
- 3.5.21 The relevant policies from the Essex Minerals Local Plan are described under Essex (below), including a review of the allocated preferred and reserved mineral extraction sites and strategic minerals infrastructure captured under Policies P1, S5 and S9.
- 3.5.22 The Essex Minerals Local Plan identified no relevant sites or infrastructure that would be impacted by the Project proposals in Thurrock. However, in the absence of a minerals local plan for Thurrock, the BGS Brits Pit data (BGS, 2022), which provides a database for active, inactive and ceased mineral workings for the United Kingdom, was reviewed.
- 3.5.23 There are no active or inactive mineral sites and workings located within the Order Limits. However, the following sites are noted in Thurrock:
- a. Tilbury 2 Aggregates terminal (considered mineral infrastructure)
 - b. East Tilbury Quarry
 - c. Mill House Farm Quarry
 - d. Rainbow Shaw Gravel Pit
 - e. Dansand Quarry
- 3.5.24 These sites have not been taken forward for further consideration within Stage 2 and Stage 3 of this assessment as the Project would not impact their operations.
- 3.5.25 Policy S8 of the Essex Minerals Local Plan and its supporting Policy map indicate two distinct areas covered by a sand and gravel MSA: in the area between Tilbury Loop line, Linford, Chadwell St Mary and the existing A13 junction with the A1089; and the North and South Ockendon areas.
- 3.5.26 The BGS Mineral Resources Map for Essex has indicated the following safeguarded geological mineral units within the Order Limits in Thurrock:
- a. Thanet Sands (Thanet Formation) (bedrock geology)
 - b. River Terrace Deposits, including Boyn Hill Gravel Member, Black Park Gravel Member, Taplow Gravel Member, and Lynch Hill Gravel Member

- 3.5.27 These units are located in the Order Limits between the Tilbury Loop line, Linford, Chadwell St Mary and the existing A13 junction with the A1089, with isolated areas of Boyn Hill and Lynch Hill gravel members located in the area of North Ockendon and along the existing M25 alignment.
- 3.5.28 The Mineral Safeguarding Assessment was shared with Thurrock on 29 January 2020. Acceptance of the approach to the minerals assessment was confirmed by Thurrock in 2021.

Segment 3: Essex

- 3.5.29 The section of the Order Limits east of the M25 and to the north of the Romford-Upminster railway branch line (which runs south of the A127) is located in Essex. This defines the border between Essex County Council, the Greater London Authority and the Havering and Brentwood.
- 3.5.30 The Brentwood Local Plan 2016-2033 (Brentwood Borough Council, 2022), adopted in 2022, confirms Essex County Council as the minerals planning authority and in Section 1.16 defers to the Essex Minerals Local Plan (2014).
- 3.5.31 The Essex Minerals Local Plan (Essex County Council, 2014) states that ‘*British Geological Survey Mineral Resource Maps provide the best available geological and resource based information on the broad extent of minerals resources in Essex.*’
- 3.5.32 The Essex Minerals Local Plan has identified mineral sites and infrastructure which are key to providing mineral demand over the adopted plan period.

Policy in relation to allocated preferred and reserved mineral extraction sites

- 3.5.33 Policy P1 of the plan identifies strategic sites where ‘*the principle of extraction has been accepted and the need for the release of mineral proven*’. Sites allocated under Policy P1 have been subject to sustainability appraisal, and subject to planning proposals meeting the detailed development requirements set out in the Minerals Local Plan. A total of 16 sites are allocated as preferred or reserve sites for sand and gravel extraction in the Essex Minerals Local Plan with a total provision of 40.82 million tonnes. A single preferred site for silica sand extraction is also identified within the plan, giving 460,000 tonnes provision.

Table 3.2 Preferred and reserved sites identified in the Essex Minerals Local Plan

Site Name	Location
Bradwell Quarry (5 sites)	Braintree
Broadfield Farm	Braintree
Colchester Quarry	Colchester
Sunnymead	Tendring
Little Bullocks Farm (2 sites)	Uttlesford
Maldon Road	Colchester
Blackley Quarry (2 sites)	Chelmsford

Site Name	Location
Shellows Cross	Chelmsford and Epping
Land at Colemans Farm	Braintree
Slough Farm	Colchester

3.5.34 The Essex Minerals Local Plan does not identify any strategic preferred or reserved sites within the Project’s Order Limits. Additionally, no active or inactive mineral extraction sites were identified on the BGS (2022) Brit Pits mapping that are within the Order Limits.

3.5.35 Policy S6 confirms that mineral extraction outside the allocated preferred and reserved sites would be resisted by the mineral planning authority, unless the applicant can demonstrate:

- a. *‘An overriding justification and/or overriding benefit for the proposed extraction; and*
- b. *The scale of the extraction is no more than the minimum essential for the purpose of the proposals; and*
- c. *The proposal is environmentally suitable, sustainable and consistent with the relevant policies set out in the Development Plan.’*

No further assessment of impacts on allocated mineral sites was taken forward to Stage 2 and Stage 3.

Policies in relation to strategic minerals infrastructure

3.5.36 In addition to the preferred and reserved mineral extraction sites, the Essex Minerals Local Plan has identified safeguarded minerals infrastructure that will help the mineral planning authority achieve the allocated provision of minerals throughout the adopted plan period. These are presented in Table 3.3 and include:

Table 3.3 Safeguarded minerals infrastructure identified in the Essex Minerals Plan

Site name	Location
Policy S9: Safeguarded transshipment sites	
Ballast Quarry	Colchester
Harlow Mill Station	Harlow
Chelmsford Rail Sidings	Chelmsford
Marks Tey Rail Siding	Colchester
Port of Harwich	Tendring
Policy S5: Strategic aggregate recycling sites	
Purdeys Industrial Estate	Rochford
Bulls Lodge Strategic aggregate recycling sites	Chelmsford
Stanway strategic aggregate recycling sites	Colchester

- 3.5.37 On review of the Essex Mineral Local Plan, it was confirmed that there are no sites covered by Policy S5 and Policy S9 within the Project's Order Limits.
- 3.5.38 Therefore, no further assessment of impacts on allocated mineral infrastructure was taken forward to Stage 2 and Stage 3.

Mineral safeguarded areas

- 3.5.39 Essex, as the mineral planning authority, has safeguarded minerals outside the preferred and reserved sites to prevent sterilisation by incompatible development and ensuring minerals remain available to future generations.
- 3.5.40 Minerals which require safeguarding are identified as sand and gravel, silica sand, chalk, brickearth and brick clay.
- 3.5.41 Policy S8 of the Essex Minerals Local Plan also states that
'By applying Mineral Safeguarding Areas (MSAs) and/or Mineral Consultation Areas (MCAs), the Mineral Planning Authority will safeguard mineral resources of national and local importance from surface development that would sterilise a significant economic resource or prejudice the effective working of a permitted mineral reserve, Preferred or Reserve Site allocation within the Minerals Local Plan.'
- 3.5.42 Policy S8 also states:
'The Mineral Planning Authority shall be consulted on:
- a. all planning applications for development on a site located within an MSA that is 5ha or more for sand and gravel, 3ha or more for chalk and greater than 1 dwelling for brickearth or brick clay; and*
 - b. any land-use policy, proposal or allocation relating to land within an MSA being considered... as part of preparing a Local Plan.'*
- 3.5.43 Paragraph 3.138 of the Essex Minerals Local Plan also states, *'In such instances, where the sterilisation of a mineral resource is at stake, it would be necessary for the development proposal to include a mineral resource assessment to enable the economic importance of the resource to be evaluated.'*
- 3.5.44 Policy S8 of the Essex Minerals Local Plan also identifies that, within Mineral Consultation Areas, *'Proposals which would unnecessarily sterilise mineral resources or conflict with the effective workings of permitted minerals development, Preferred or Reserve Mineral Site allocation shall be opposed.'*
- 3.5.45 The Essex Minerals Local Plan goes on to state that *'if it proves necessary for development to take place within an MSA, then the presence of mineral resources and the potential for prior extraction of minerals should be considered'* (Paragraph 3.127).
- 3.5.46 Appendix 5 of the Essex Minerals Local Plan states that:
- 3.5.47 *'the Essex district/borough/city councils (as a Local Planning Authority) should consult the Minerals Planning Authority (Essex County Council) on planning applications situated within Mineral Safeguarding Areas (MSAs) and Mineral Consultation Areas (MCAs) to ensure that specific mineral resources are not needlessly sterilised by future development.'*

- 3.5.48 Essex were consulted via email regarding potential mineral resources coinciding with the areas of the Order Limits in Essex. They confirmed by email on 27 September 2018 that there were no mineral resources in Essex within the Order Limits. Essex County Council provided a screenshot of a GIS viewer indicating mineral resources within Essex County Council's authority area, but not within or adjacent to the Order Limits. It should be noted that Thurrock is not shown on the Essex GIS viewer, and it was confirmed by Essex that Thurrock is not part of its administrative area.
- 3.5.49 Essex also confirmed that the clay deposits (Head Deposits, Claygate Member, London Clay Formation and Alluvium) are not considered by Essex County Council to be within an MSA and hence are not considered further in this assessment.
- 3.5.50 Although the Order Limits have been extended within Essex since the engagement in 2018, the updated minerals baseline has not identified any new effects on MSAs within the Order Limits. During email correspondence with Thurrock Council regarding the approach to minerals management within the Order Limits, Essex County Council confirmed again that each singular MSA impacted is below the 5ha threshold which triggers the mineral safeguarding policy in their Minerals Local Plan and therefore would not trigger the policy requirement for further assessment.

Segment 4: Havering

- 3.5.51 The Project's Order Limits cross Havering's administrative area to the south of North Ockendon. Broadly, Havering incorporates the area around North Ockendon and to the west of the M25 to the north of the Romford – Upminster railway branch line.
- 3.5.52 Policy SI 10 Aggregates of the London Plan (Greater London Authority, 2021) requires all Mineral Planning Authorities in their development plans to identify MSAs to protect sand and gravel resources from development that would otherwise sterilise future potential extraction.
- 3.5.53 Policy 37 of the Havering Local Plan 2016-2031, adopted in November 2021 (London Borough of Havering, 2021) states that '*Non-mineral development in safeguarded areas will only be considered where the applicant can demonstrate that:*
- i. the development will not sterilise the minerals resource*
 - ii. the mineral concerned is no longer of any value or potential value*
 - iii. the minerals can be extracted prior to the development taking place and this does not render the site unsuitable for the proposed surface development*
 - iv. it is not practicable or economic to extract the minerals prior to the development taking place*
 - v. The development is required for agriculture, forestry or nature conservation or for open air recreation and would be otherwise acceptable*
 - vi. there is an overriding need for the incompatible development.'*

- 3.5.54 The MSAs for Havering are shown on the Havering Policies Map November 2021 (London Borough of Havering, 2021), which support the adopted Local Plan and indicates a large area as an MSA to the south-east of Hornchurch, including land to the east (North Ockendon) and west of the M25.
- 3.5.55 The BGS (BGS, 2022) Essex Minerals Map, which includes Havering, shows pockets of sand and gravel mineral resources within the Order Limits, comprising Lynch Hill Gravel Member and Boyn Hill Gravel Member within and close to the alignment of the existing M25 motorway, south of the A127.
- 3.5.56 During discussions held with Havering on 30 August 2018, it was confirmed that the minerals which the Council considered safeguarded within the MSA are the superficial deposits of sands and gravels. These comprise Lynch Hill Gravel Member and Boyn Hill Gravel Member within and close to the alignment of the existing M25 motorway, south of the A127 (Figure 1). Through discussions with the Havering and Essex, it is understood that the clay deposits (Head Deposits, Claygate Member, London Clay Formation and Alluvium) are not within an MSA. The engagement with the Council confirmed that the clay deposits are not considered a safeguarded resource.
- 3.5.57 During the meeting, Havering advised their preference for reusing any resources extracted as part of the Project, and that minerals that are deemed to be economically unviable or cause a negative impact on structures or the environment should not be excavated.
- 3.5.58 Policy 38 states mineral extraction from the MSA would only be supported where there was no unacceptable impact on public health and safety, amenity and quality of life of nearby communities, the natural, built and/or historic environment and the effective operation of the road network, including safety and capacity. Within its Local Plan, Havering also notes the potential for cumulative effects from multiple sites becoming active, putting pressure on communities and infrastructure.
- 3.5.59 The Havering Local Plan does not include any allocated mineral extraction sites and a review of the BGS (2022) Brit Pits database did not highlight any active or inactive mineral extraction sites within or adjacent to the Order Limits.

Summary

- 3.5.60 A review of the Kent Minerals and Waste Local Plan confirmed that the Project would not impact allocated mineral extraction sites or mineral infrastructure (such as wharves and rail heads).
- 3.5.61 Consultation with Kent and a review of the Kent Minerals and Waste Local Plan confirmed that the MSAs relevant to the Project were the sub-Alluvial River Terrace Deposits and River Terrace Deposits, identified on the Gravesham Borough Council minerals map.
- 3.5.62 No MSAs were identified within the Order Limits in Maidstone, Tonbridge and Malling and Medway.

- 3.5.63 Although the Project Order Limits cross the sub-Alluvial River Terrace Deposits and River Terrace Deposits in Gravesham, Kent confirmed that they would not support prior mineral extraction in or adjacent to the Thames Estuary and Marshes Special Protection Area and Ramsar site and the South Thames Estuary and Marshes Site of Special Scientific Interest (which stretches along the River Thames) due to the potential for adverse impacts on the internationally designated wetland.
- 3.5.64 North of River Thames, the Essex Minerals Local Plan, adopted in 2014, is relevant for Essex and Brentwood. Despite being a unitary authority, it was confirmed that Thurrock adopts the Essex Minerals Local Plan.
- 3.5.65 Preferred and reserved extraction sites are safeguarded via Policy P1, while Policies S5 and S9 safeguard minerals infrastructure. No safeguarded extraction sites or infrastructure are located within the Project Order Limits.
- 3.5.66 Policy S8 designates MSAs in Essex, Brentwood and Thurrock.
- 3.5.67 The technical engagement and a review of the supporting Policy Maps and BGS (2002) Minerals Resource Map for Essex confirmed the following:
- a. There are no MSAs located within the Order Limits in relation to land for which Essex and Brentwood are the relevant minerals authority.
 - b. Within Thurrock, the Order Limits cross an MSA designated for sands and gravels comprising the following units:
 - i. Thanet Formation (Bedrock geology comprising silica sand).
 - ii. River Terrace Deposits, including Boyn Hill Gravel Member, Black Park Gravel Member, Taplow Gravel Member, and Lynch Hill Gravel Member.
- 3.5.68 Policy 37 of the Havering's Local Plan, adopted in November 2021, was reviewed and indicated a wider area considered an MSA within Havering. Technical engagement with Havering confirmed that sand and gravels were key resources considered for safeguarding, and the BGS mineral resources mapping identified the relevant units as the Lynch Hill and Boyn Hill Gravel Members located adjacent to the existing M25 alignment.
- 3.5.69 Figure 1 presents a baseline of relevant safeguarded minerals following the policy review and engagement. Table 3.4 provides a summary of technical engagement with Mineral Planning Authorities.

Table 3.4 Summary of engagement with minerals planning authority

Mineral Authority	Description of engagement	Engagement Date
Kent County Council	Technical engagement meeting to discuss mineral policy, safeguarded minerals and potential effects of surface extraction at the Thames Estuary and Marshes Ramsar site.	27 July 2018
Thurrock Council	Thurrock was issued the Mineral Safeguarding Assessment.	29 January 2020
	Statement of Common Ground meeting – confirmation of acceptance of mineral safeguarding assessment.	21 September 2021
Essex County Council	Email correspondence to confirm mineral policy and confirm that Project impacts would not trigger further assessment on mineral safeguarding areas. Acceptance of approach to the mineral safeguarding assessment.	17 February 2020
London Borough of Havering	Technical engagement meeting to discuss minerals policy and economic minerals potentially impacted by the Project.	30 August 2018
All Mineral Planning Authorities	Issue of the mineral safeguarding assessment to the relevant Mineral Planning Authority	November 2020

4 Minerals Baseline (Stage 2)

4.1 Introduction

- 4.1.1 This section details the nature of the MSAs that have been identified within the Order Limits and could potentially be impacted by the Project. Collectively, this has been termed the minerals baseline. It also provides a summary of the key constraints prior to extraction of minerals that have been identified in relation to the land subject to permanent acquisition by the Project.
- 4.1.2 When determining the safeguarded mineral baseline, the following documents and information sources were used:
- British Geological Survey (2002). Mineral Resources Map for Essex
 - British Geological Survey (2003b). Mineral Resources Maps for London Boroughs
 - British Geological Survey Geology 1:50,000: Superficial Deposits
 - British Geological Survey Geology 1:50,000: Bedrock Deposits
 - British Geological Survey (undated). Onshore Geindex (online geological database accessed in 2018)
 - The Ground Model (Application Document 6.3, Appendix 10.5), presenting a geological long section for the Order Limits derived from a 3D model built from the findings of the Project Ground Investigation and historical boreholes.

4.2 Segment 1: Kent

Safeguarded mineral extraction sites, workings and infrastructure

- 4.2.1 In relation to Policies CSM 2, CSM 3 and CSM 6 of the Kent Minerals and Waste Local Plan, no allocated mineral extraction sites or minerals infrastructure were identified within the Order Limits.

Mineral safeguarding areas

- 4.2.2 The Project crosses MSAs that are located between Lower Higham Road and the River Thames, comprising sub-Alluvial River Terrace Deposits and River Terrace Deposits at or near the ground surface (Lynch Hill and Taplow sand and gravel). This is shown on the Gravesham Mineral Safeguarding Areas Map (Kent County Council, 2020) and Figure 1 and is included within the Kent Minerals and Waste Local Plan (Kent County Council, 2020).
- 4.2.3 The Ground Model (Application Document 6.3, Appendix 10.5) confirms the presence of River Terrace Deposits in line with the Gravesham Mineral Safeguarding Areas mapping. Typically, the safeguarded mineral resource is not found at surface and predominantly underlies Head Deposits or Alluvium, reducing the potential viability of mineral extraction.

- 4.2.4 Discussions with Kent revealed that the local authority typically only wishes to safeguard the River Terrace Deposits because of their extent across the county; other potential resources are limited in their extent. The River Terrace Deposits within the Order Limits are located within or directly adjacent to the Thames Estuary and Marshes Special Protection Area and Ramsar site and therefore are unlikely to be viable for mineral extraction. The Project Ground Model indicates that the River Terrace Deposits are typically overlain by Head Deposits and Alluvium deposits which increase in thickness towards the River Thames. This would further reduce the viability of mineral extraction,
- 4.2.5 Although the Project would result in the potential sterilisation of a proportion of the safeguarded sub-Alluvial River Terrace Deposits and the River Terrace Deposits, prior surface extraction under Policy DM 9 is not deemed appropriate due to the potential adverse effects the works may have on the Thames Estuary and Marshes Ramsar site, which has an international designation. It should be noted, however, that the Project is in tunnel in this area, and it is envisaged that some mineral resources would be extracted through the tunnelling works and reused, recycled and recovered in the Project works. Further information can be found in Section 5.

4.3 Segment 2: Thurrock

Safeguarded mineral extraction sites, workings and infrastructure

- 4.3.1 No preferred or reserved mineral extraction sites or minerals infrastructure safeguarded under Policy P1, Policy S5 and Policy S9 were identified within the Order Limits.
- 4.3.2 In the absence of a Minerals Local Plan for Thurrock, a review of the BGS (2022) Brit Pits data was carried out to identify existing active and inactive mineral extraction sites, workings and minerals infrastructure in Thurrock. Notable active and inactive mineral sites in Thurrock are listed below:
- Tilbury 2 Aggregates terminal (considered mineral infrastructure through aggregates processing)
 - East Tilbury Quarry – aggregates recycling
 - Mill House Farm Quarry – Boyn Hill Gravel Member extraction
 - Rainbow Shaw Gravel Pit – Thanet Formation
 - Dansand Quarry – aggregates recycling
- 4.3.3 None of the sites identified are located inside the Order Limits and therefore no impact is likely to occur on their operations.

Mineral safeguarding areas

- 4.3.4 The safeguarded minerals located within the Order Limits in Thurrock are:
- Thanet Formation (bedrock geology)
 - River Terrace Deposits (superficial geology), including Boyn Hill Gravel Member, Taplow Gravel Member, and Lynch Hill Gravel Member

- 4.3.5 The BGS Mineral Resources Map for Essex presents the mineral resources for Essex and surrounding mineral authorities. Figure 1 presents the relevant safeguarded mineral resources (both superficial and bedrock deposits) located in Thurrock and the Project's Order Limits and therefore at risk of impact.

Safeguarded bedrock geology

- 4.3.6 Bedrock geology within this area comprises Chalk at the margin of the Thames near Grays and Tilbury, small areas of the Thanet Formation, Lambeth Group and Harwich Formation further north between Chadwell St Mary and the A13, and London Clay Formation north of the A13. These bedrock strata are very rarely seen at surface and are typically obscured by Alluvium, River Terrace Deposits and/or Head, making viability of extraction varied.
- 4.3.7 The Thanet Formation is identified as a mineral resource on the BGS Mineral Resources Map for Essex and is considered safeguarded. This geological unit is identified within the Order Limits in two locations: land between Muckingford Road, Hoford Road and Brentwood Road; and land east of East Tilbury. In addition, small pockets of Thanet Formation are also found adjacent to the former Low Street Pitt works and Tilbury Loop Line. The Ground Model (Application Document 6.3, Appendix 10.5), which has been developed using Project Ground Investigation and historical boreholes indicates that the Thanet Formation becomes more prominent at surface between the Tilbury Loop line and the A13 junction with minimal overburden, making mineral resources more accessible for shallow excavations within this section of Project.
- 4.3.8 To the east of East Tilbury, and areas closer to the River Thames, the viability of extraction would reduce where Alluvium overlays the Thanet Formation or where groundwater or surface water control would be required. The Thanet Formation has been extracted where it is present at or near the ground surface, for example at East Tilbury Quarry and Dansand Quarry, but extraction is not considered to be commercially viable where it is overlain by the London Clay Formation or Alluvium. The Project would not affect the workings and operations of these active sites.
- 4.3.9 In line with paragraph 3.138 of the Essex Minerals Local Plan (2014), an assessment of the Project's effects on the identified bedrock MSAs is presented in Section 5 and Section 6.

Safeguarded superficial geology

- 4.3.10 River Terrace Deposits, which are sands and gravels with occasional beds of silty sand and peat, are shown on the BGS (2002) Mineral Resources Map for Essex and are considered safeguarded under the Essex Minerals Local Plan (2014). Generally, the safeguarded minerals are located within the Order Limits between the Tilbury Loop Line and Stifford Clays Road, with small pockets of minerals identified in South Ockendon and along the alignment of the M25.
- 4.3.11 The sand and gravel deposits within Thurrock's administrative area and their location within the Order Limits are described in Table 4.1 and presented in Figure 1. The Ground Model in Appendix 10.5 (Application Document 6.3) provides a geological long section.

Table 4.1 Description of MSAs within Segment 2 Thurrock

Mineral Safeguarded Unit	Description within Order Limits
Taplow Gravel Member	Mapping indicates the Taplow Gravel Member being present within the Order Limits to the west of East Tilbury and Linford and extending from 450m south of the Tilbury Loop line to Muckingford Road.
Boyn Hill Gravel Member	Mapping indicates that the Boyn Hill Gravel Member is found around Orsett Heath and the existing A13 junction with the A1089. Within the Order Limits, it extends from Hoford Road north to Stifford Clays Road. There are also small areas of gravel located at South Ockendon (North Road). An existing quarry (Mill House Farm Quarry) and ceased mineral working to the west of Hoford Road indicates that the minerals are viable in localised areas.
Lynch Hill Gravel Member	There are two small outcrop areas of Lynch Hill Gravel Member present within the Order Limits. These are located to the west of the Project route at East Tilbury and along the existing alignment of the M25, to the south of the London Tilbury and Southend railway line.

- 4.3.12 The gravel members are all present at elevations above the Thames alluvium. All members predominantly comprise sand or sand and gravel, but they may locally include lenses of silt, clay or peat. The Ground Model (Application Document 6.3, Appendix 10.5) and British Geological Survey maps and records show each member has a thickness of 3 to 7m but may locally reach 12m where hollows in subjacent bedrock are infilled. These members are commonly present at depth, but are also found beneath Head Deposits and below Alluvium at the margin of the River Thames. River Terrace Deposits are also present under the River Thames, although these would be inaccessible for extraction via surface workings.
- 4.3.13 There is evidence of historical mineral extraction in these geologies within and adjacent to the Order Limits, including former sites at Hoford Road and Rainbow Shaw Gravel Pits, both extracting the Black Park Gravel Member. Further evidence of historical extraction is at Station Road where the Low Street and Gravel Pit Farm Gravel Pits indicate previous workings for the Taplow Gravel Member.
- 4.3.14 The Mill House Farm quarry is an active site extracting the Boyn Hill Gravel Member. This is adjacent to the Order Limits along Hoford Road.
- 4.3.15 In line with paragraph 3.138 of the Essex Minerals Local Plan, an assessment of the Project's effects on the identified superficial MSAs is presented in Section 5 and Section 6.
- 4.3.16 Between the River Thames and the Tilbury Loop line, an historical land raise is located where the proposed North Portal would be located. The Project Ground Model and BGS mapping does not indicate any mineral resources within this area and, therefore, it has been assumed that mineral extraction of sands and gravels within the River Terrace Deposits has either already taken place or is not viable due to the substantial thickness of alluvium and the land raising

activities that have taken place. The BGS mapping also confirms there are no mineral resources to the east of the North Portal site within the East Tilbury Marshes and Coalhouse Fort areas.

- 4.3.17 To the north of Stifford Clays Road, where the Project crosses the River Mardyke valley, the Ground Model (Application Document 6.3, Appendix 10.5) and BGS mapping indicates that superficial deposits are dominated by Alluvium and Head Deposits over London Clay bedrock, which are not considered to be of economic importance or safeguarded since they do not appear on the Mineral Resources Map for Essex. Project ground investigation records indicate that where Head Deposits are present above sand and gravel resources, the thickness is typically 5m. Intertidal alluvium at the margins of the River Thames is considerably thicker, and 10 to 20m is present above the sub-Alluvial sand and gravel.
- 4.3.18 Pockets of Lynch Hill Gravel Member are located where the Project crosses beneath North Road and at the M25 alignment. The Project borehole data presented on the Ground Model suggests that these minerals resources are typically between 2m-7m thick and are found to be overlain by a similar thickness of head deposits. This effects the commercial viability of extracting the mineral in this area.
- 4.3.19 Evidence of historical mineral abstraction within the superficial deposits are found at the existing A13/A1089 junction, namely the former Mobbs Farm and Baker Street sites.

4.4 Segment 3: Essex

- 4.4.1 No preferred or reserved mineral extraction sites and safeguarded minerals infrastructure allocated within the Essex Minerals Local Plan were identified within or close to the Order Limits.
- 4.4.2 A review of the BGS (2002) Essex Mineral Resource Map shows that there are no mineral safeguarded areas within the Order Limits where the project falls within the Essex authority boundary. This is further supported by the Ground Model (Application Document 6.3, Appendix 10.5).
- 4.4.3 Therefore, no further assessment has been taken forward in relation to safeguarded minerals within Essex.

4.5 Segment 4: Havering

- 4.5.1 The identified safeguarded minerals within the Order Limits in Havering are superficial deposits:
- a. Boyn Hill Gravel Member
 - b. Lynch Hill Gravel Member
- 4.5.2 Figure 1 indicates that the Boyn Hill Gravel Member is located to the north of the London, Tilbury and Southend railway line and Lynch Hill Gravel Member is generally found to the south of the railway. Within the Order Limits, both members are located close to the existing M25 motorway and are considered to have already been sterilised, since their removal would undermine existing motorway structures.

- 4.5.3 The ground investigation information presented in the Ground Model (Application Document 6.3, Appendix 10.5) shows the varied thickness of the mineral resource in this area, with a maximum of approximately 15m, is typically overlain by 5m-10m of Head Deposits. This would likely significantly affect the viability of mineral extraction.
- 4.5.4 An assessment of the Project's effects on these units is presented in Section 5 and Section 6 of this document.

4.6 Constraints impacting on the practicality of mineral extraction

- 4.6.1 When reviewing the practicality of mineral extraction outside the strategically allocated sites of the local plan, consideration needs to be given to any constraints that might already exist and thus might affect the likely success of planning consent under the minerals local plans and the viability of future workings. All the plans developed by the Mineral Planning Authorities, discussed in 3.5, state that mineral development would need to demonstrate sustainable development through environmental suitability, alongside overriding justification/benefit for the extraction. In the case of Essex, minerals development outside the allocated preferred and reserved sites would be resisted.
- 4.6.2 A desktop assessment has been undertaken of potential constraints which are likely to apply both within and adjacent to the Order Limits and that could limit future extraction regardless of the Project. Where applicable, the following potential environmental and planning aspects were considered in line with the development management policies of the Local Plans:
- a. Natural and geological environment
 - i. Designated environmental sites
 - ii. Biodiversity features
 - iii. Water environment including groundwater and flood risk
 - iv. Soil resources from best and most versatile agricultural land
 - b. Human receptors
 - i. Proximity to residential areas, schools and other sensitive land use potentially impacted by noise and dust
 - ii. Public open space and public rights of way
 - c. Built environment
 - i. Businesses, private property and housing
 - ii. Agricultural land and holdings
 - iii. Existing infrastructure including highways and utilities

4.6.3 Mineral extraction activities have the potential to result in adverse effects on receptors in relation to the generation of dust, noise and vibration disturbance, impacts on the hydrology and hydrogeology regime, a deterioration in the landscape and environmental setting, land instability, loss of public amenity and direct loss of an environmental resource. To reflect the fact that the potential effect pathways would not be restricted to the boundary of a proposed mineral working, a minimum buffer zone was applied to each constraint to give a reasonable reflection of potentially extractable minerals. The buffer zones are based on the type and sensitivity of the receptor and have been applied conservatively to inform the greatest potential viability of mineral extraction. In reality, constraints would need to be assessed on a case by case basis in consultation with the relevant stakeholder and/or regulator. The development constraints are presented in Figure 2 and have informed the following buffer zones:

a. Natural and Geological Environment

- i. Mineral extraction should be more than 20m from nature designations, including Sites of Special Scientific Interest, Special Areas of Conservation, Ramsar site, Special Protection Areas, Local Nature Reserves, Site of Importance for Nature Conservation, and Local Wildlife Sites.
- ii. Mineral extraction should be more than 20m from identified watercourses.
- iii. No mineral extraction should take place within a SPZ 1.
- iv. No mineral extraction should take place within areas of Flood Zone 2 and Flood Zone 3.
- v. Mineral extraction should be more than 20m from woodland features,
- vi. Mineral extraction should avoid best and most versatile agricultural land.

b. Human Receptors

- i. Mineral extraction should be more than 100m from residential properties (as noted in the Essex Minerals Local Plan).
- ii. Mineral extraction should be more than 20m from public rights of way.
- iii. No mineral extraction should take place within 20m of areas designated as public open space.

c. Built Environment

- i. Mineral extraction should be more than 20m from above and below ground utility infrastructure.

- ii. Mineral extraction should be more than 20m from the minor (local) road network.
- iii. Mineral extraction should be more than 100m from the centre point of the strategic road network (A13, A1013, A1089 and M25) to account for embankments, structures and drainage.
- iv. Mineral extraction should be more than 20m from historical landfills.
- v. Mineral extraction should be more than 20m from Scheduled Monuments.
- vi. Mineral extraction should be more than 20m from Registered Parks and Gardens.
- vii. Mineral extraction should be more than 20m from Listed Buildings.
- viii. Mineral extraction should be more than 20m from Conservation Areas.
- ix. Mineral extraction should be more than 50m from the centre point of railway lines due to sensitivity of assets to the effects of settlement and land instability.

4.6.4 In addition to the constraints listed above, the potential for a reduction in the safety and capacity of the local road network, as well as access to main/strategic roads, should be considered as traffic movements would increase during the extraction process.

4.7 Summary

Segment 1: Kent

4.7.1 The Project crosses an area with safeguarded minerals (sub-Alluvial River Terrace Deposits and River Terrace Deposits) and coincides with the Thames Estuary and Marshes Ramsar site, which is an internationally designated site. In addition, Lower Higham Road crosses this area.

Segment 2: Thurrock

4.7.2 Within Thurrock and the Project Order Limits, there are a number of constraints that have been identified that would likely restrict prior extraction of minerals (Figure 2).

4.7.3 The land located between the Tilbury Loop line and Stifford Clays Road has a number of existing constraints including rail infrastructure (Tilbury Loop railway line), minor roads (Muckingford Road, Hoford Road, Brentwood Road) and strategic roads (the A13, the A1089 and their interchange). The minor roads are reflective of the local road connections between individual dwellings and the larger urban areas of Chadwell St Mary, Linford and Orsett Heath. Linear utility infrastructure in the form of overhead power lines is also present within the area. A watercourse is noted as running north-south between Brentwood Road and Linford. There are also pockets of woodland running north to south between Brentwood Road and Linford.

- 4.7.4 There are areas of safeguarded minerals that could potentially be permanently sterilised due to the Project. These are typically characterised by arable fields between the road and utility infrastructure constraints. Figure 2 indicates that these are generally discrete pockets of land which could limit potential viability due to space and access constraints.
- 4.7.5 A review of the Agricultural Land Classification (ALC) information presented in Figure 10.4 (Application Document 6.2) shows the area between the Tilbury Loop line and Stifford Clays Road to be dominated by ALC grade 3a and ALC grade 3b. Therefore, any mineral workings promoted within this area would contribute to the loss of best and most versatile land.
- 4.7.6 In line with Policy S11 of the Essex Minerals Local Plan (2014), a key consideration to the viability of mineral extraction is transportation and access. Paragraph 3.178 of the Essex Minerals Local Plan introduces three tiers of route hierarchy with preference given to the use of existing direct accesses to the main road network or the creation of new access/junctions. The nature of the road network (Muckingford Road, Hoford Road and Brentwood Road) that would be used for transportation within the area between the Tilbury Loop line and the A13 would likely fall in the third tier, as it would require the use of long stretches of minor/local roads prior to accessing the main and strategic road network. These roads provide local connections between local communities and any mineral workings would significantly increase the vehicle movements in the area. Mineral workings within this area may also require substantial road improvements, such as junction upgrades, road widening and new accesses, which could impact extraction viability due to the additional cost which this would involve.
- 4.7.7 Further discussion on the assessment on safeguarded mineral within Thurrock and the Order Limits are discussed below in Section 5.

Segment 3: Essex

- 4.7.8 No constraints to mineral extraction were reviewed as there are no safeguarded minerals identified as being impacted within or adjacent to the Order Limits by the Project in Essex.

Segment 4: Havering

- 4.7.9 As presented in Figure 2, the section of the Project Order Limits that falls within Havering is affected by a number of existing constraints that would limit the likelihood and viability of mineral extraction. These include the existing M25 alignment and its associated earthworks, open space associated with the Thames Chase Forest Centre, the London, Tilbury and Southend railway line, utility assets and residential buildings located on Church Lane and Ockendon Road.
- 4.7.10 An area of Boyn Hill Gravel Member, which is a safeguarded mineral that could be potentially sterilised, is located to the east and west of the M25 at the Ockendon Road crossing. Further discussion on the assessment of potential sterilisation resulting from the Project within Havering is provided in Section 5.

5 Assessment of safeguarded mineral sterilisation (Stage 3)

5.1 Introduction

- 5.1.1 In line with the findings of the baseline studies, it was determined that the Project may have a potential effect on some areas of safeguarded minerals within Kent, Thurrock and on a small area at the southern part of the M25 in Havering.
- 5.1.2 Following the technical engagement and the baseline review, Segment 3: Essex was not taken forward to the stage 3 assessment.

5.2 Method

- 5.2.1 To determine the potential effects on the identified safeguarded mineral areas, the following information was used as part of the GIS processing routines:
- Project map layers relating to the land within the Order Limits subject to permanent acquisition
 - Mapped extents of land covered by existing constraints (as described in Section 4.6)
 - BGS mapping data for the identified safeguarded mineral units
- 5.2.2 The effects of sterilisation were assessed against the land subject to permanent acquisition rather than the overall Order Limits. The Order Limits incorporate land which is required on a temporary basis and land where rights would be retained. These areas would be returned to their original owner following completion of the works and there would be no permanent loss of resource resulting from the Project.
- 5.2.3 The data layers were processed to calculate the following information:
- Total area of land subject to permanent acquisition within the segment
 - Total area of land subject to permanent acquisition within segment with existing development constraint as described in Section 4.6
 - Total area of land subject to permanent acquisition without existing development constraint which crosses an MSA
- 5.2.4 A comparison of these areas gave an estimate of viable safeguarded mineral resource likely to be sterilised by the land subject to permanent acquisition. This allowed the potential effects of the Project to be put into context with the wider availability of minerals across the relevant authority's area.

5.3 Project design and mitigation

Mitigation – prior extraction and material asset management

- 5.3.1 The Project design has been optimised to minimise the land required to construct and operate the Project and maximise the land reinstated and returned to owners. Where land is returned, the Project would not result in the permanent sterilisation of underlying mineral resource.
- 5.3.2 Where avoidance of safeguarded mineral units has not been possible and in line with Paragraph 5.182 of the NPSNN, the Applicant has sought to identify appropriate mitigation measures. These measures will prioritise the prior extraction and reuse, recycling and recovery of materials excavated as part of the construction works within the Project design (for example, as engineering and landscape filling, embankment construction). Measures have been included within the Register of Environmental Actions and Commitments (REAC) which forms part of Appendix 2.2 of the Code of Construction Practice (Application Document 6.3). Each entry in the REAC has an alpha-numerical reference code (e.g. MW0XX) to provide cross reference to the secured commitment.
- 5.3.3 The following measures are noted in the REAC in relation to the prior extraction and reuse, recovery and recycling of excavated materials where the proposed footprint of the road requires excavation to formation level:
- Excavated material (and all wastes) would be managed in line with the waste hierarchy. Preference will be given to appropriate reuse, recycling and/or recovery before disposal where feasible and permitted by the design. Where excavated materials and soils are to be reused, recycled and/or recovered within the Order Limits, this would be subject to the relevant regulatory controls: for example, Directive 2008/98/EC on Waste (Waste Framework Directive), Article 2, environmental permit, exemption and/or a Materials Management Plan as per the Definition of Waste: Development Industry Code of Practice (CL:AIRE, 2011). Where excavated materials and soils cannot be reused, recycled and/or recovered within the Order Limits, opportunities should be sought within schemes or facilities outside of the Order Limits. The final option would be disposal (MW007).
 - Through a combination of one or more of reuse, recycling and/or recovery the Contractors would achieve a minimum of 95% (by weight) of inert excavation wastes and a minimum of 95% (by weight) of inert construction and demolition waste destined for offsite waste management outside the Order Limits would be diverted from final disposal in landfill (MW011).
 - Through a combination of one or more of reuse, recycling and/or recovery the Contractors shall achieve a minimum of 70% (by weight) with a target of 90% (by weight) of non-hazardous excavated wastes and a minimum of 70% (by weight) with a target of 90% (by weight) of non-hazardous construction and demolition waste that are destined for off-site waste management outside the Order Limits, and therefore would be diverted from final disposal in landfill (MW013).

- d. The Contractor shall use the information and data available to identify what site-won excavated materials can be used as Class I-IV material or aggregate. Should it be required, supplementary data and information shall be obtained in order to assess the potential availability and suitability of excavated materials to meet the relevant material specifications (MW008).
- e. All excavated materials and soils proposed for reuse under a Materials Management Plan would be required to meet risk-based acceptability criteria applicable to its intended use. The procedures and criteria to be used would be set out in the Materials Management Plan (REAC ref. MW007) prior to commencement of that part of the works (GS006).

5.4 Segment 1: Kent

- 5.4.1 Within Kent the safeguarded minerals are located beneath and adjacent to the Thames Estuary and Marshes Special Protection Area and Ramsar site. Approximately 14,500m² (1.4ha) could potentially be sterilised by the Project where the minerals are located outside of the Ramsar site. Extraction here would be likely to cause adverse impacts on the Ramsar designation through groundwater and surface water impacts and disturbance of birds from the workings. Additionally, the ground investigation data, as presented on the Ground Model (Application Document 6.3, Appendix 10.5) indicate a minimum thickness of 5m of Head Deposits and Alluvium overlying the mineral resources, which would increase the scale of any surface extraction and reduce viability.
- 5.4.2 Prior extraction would not meet the requirements of Policies DM 2, DM 7 and DM 8 of the Kent Minerals and Waste Local Plan. This was noted and supported through technical engagement with Kent (refer to paragraph 3.5.16).

5.5 Segment 2: Thurrock

- 5.5.1 Within Thurrock, the extent of land subject to permanent acquisition is approximately 7.4 million m², of which 3.8 million m² has development constraints that could limit mineral extraction. Of the 3.6 million m² remaining, only approximately 1.5 million m² coincide with safeguarded minerals that could be sterilised by the Project equating to 150ha. Project ground investigation as presented in the Ground Model (Application Document 6.3, Appendix 10.5) indicate that mineral resources between the Muckingford Road and Stifford Clays Road are typically found close to the surface.
- 5.5.2 Within Essex (which includes Thurrock), the total safeguarded area for sand and gravel is 130,387ha. When the area of safeguarded sands and gravels potentially sterilised within the Order Limits (150ha) is compared against the total safeguarded area of sand and gravels in Essex, this equates to approximately 0.12%.
- 5.5.3 Figure 3 presents the results of the assessment in Thurrock and highlights the areas of safeguarded mineral within the area subject to permanent acquisition that would potentially be sterilised by the Project. Figure 3 helps to put the total area affected by the Project into context and indicates a patchwork of small, discrete sites that would potentially be permanently sterilised by the Project.

- 5.5.4 A review of the Agricultural Land Classification (ALC) information presented in Figure 10.4 (Application Document 6.2) indicates the area between the Tilbury Loop line and Stifford Clays Road to be dominated by ALC grade 3a and ALC grade 3b. Therefore, any mineral workings promoted within this area would likely result in the loss of the best and most versatile land.
- 5.5.5 The nature of the road network (Muckingford Road, Hoford Road and Brentwood Road) that would be used for transportation within the area between the Tilbury Loop line and the A13 would likely fall in the third tier of the route hierarchy noted within the Essex Minerals Local Plan (2014). Access to mineral workings within the areas affected by the Project would require the use of long stretches of minor/local roads prior to accessing the main and strategic road network. These roads provide local connections between local communities and any mineral workings would likely significantly increase the vehicle movements in the area and reduce the overall safety for road users. Mineral workings within this area may also require substantial road improvements, such as junction improvements, road widening and new accesses, which could impact extraction viability due to the additional costs.
- 5.5.6 Policy S6 of the Essex Minerals Local Plan states that mineral extraction outside preferred or reserve sites will be resisted by the Mineral Planning Authority unless the applicant can demonstrate:
- a. *'An overriding justification and/or overriding benefit for the proposed extraction; and*
 - b. *The scale of the extraction is no more than the minimum essential for the purpose of the proposal; and*
 - c. *The proposal is environmentally suitable, sustainable, and consistent with the relevant policies set out in the Development Plan.'*
- 5.5.7 The Project proposals include commitments (MW007) for the Contractors to prioritise the prior extraction and reuse, recycling and recovery of materials excavated as part of the construction works within the Project design (for example, as engineering and landscape filling, embankment construction), which would reduce the level of sterilisation likely to occur within these areas and result in a reduction in impact reported in this report. Any minerals not excavated as part of the proposals would remain *in situ*.
- 5.5.8 In line with Policy S6, the full extraction of all safeguarded minerals prior to the Project construction would not be practical, environmentally feasible or sustainable due to the following adverse effects:
- a. Significant delay to the completion of construction and the opening date of the Project, reducing the viability of a nationally significant infrastructure project. The Project is of national interest due to the economic, safety and environmental impacts it will help to resolve.
 - b. The local road network being unsuitable to support the increased vehicles movements associated with the workings due to their proximity to local communities and residential areas and lack of direct access to the main and strategic road network. This would reduce road safety for other road users.

- c. Extension of the overall construction programme, leading to an extended disturbance of communities in relation to construction activities and loss of amenity through dust and noise.
- d. An increase in carbon emissions due to increased traffic movements and construction activity associated with additional excavations, material processing, material import (to backfill voids created by the extraction process) and export of surplus materials.
- e. More significant groundworks, leading to potential risks in land instability and requirements for groundwater control.
- f. A significant loss of best and most versatile (BMV) agricultural land, potentially effecting the viability of agricultural land holdings and businesses.

5.6 Segment 4: Havering

- 5.6.1 Within Havering, the extent of land subject to permanent acquisition is approximately 1.4 million m², of which 1.2 million m² has development constraints that could limit mineral extraction. Of the 200,000m² remaining, 62,700m² coincide with safeguarded minerals that could be sterilised by the Project, equating to approximately 6.2ha.
- 5.6.2 Project ground investigation presented in the Ground Model (Application Document 6.3, Appendix 10.5) shows that safeguarded mineral resources potentially sterilised by the Project in Havering are typically overlain by 5-10m of head deposits, which would affect the viability of prior surface extraction.
- 5.6.3 As described above, the Project is committed to prioritising the prior extraction and reuse, recovery and recycling of excavated materials within the permanent works. The majority of the potential sterilisation is likely to occur within the Boyn Hill Gravel Member, where the northbound Project road is in a cutting beneath the existing M25. Therefore, any minerals excavated by the works at this location would likely be reused as part of the works, reducing the overall impact on the mineral resource.

6 Conclusion

6.1.1 Table 6.1 provides a summary on the Project’s potential impact on safeguarded minerals, as presented in Figure 3.

Table 6.1 Summary of the impact on safeguarded minerals and infrastructure within the Order Limits

Mineral Authority	Allocated mineral extraction sites and infrastructure within Order Limits	Safeguarded minerals within Order Limits (land subject to permanent acquisition only)	Potential sterilisation within land subject to permanent acquisition
Kent County Council	None identified	Sub-Alluvial River Terrace Deposits River Terrace Deposits Safeguarded minerals are located beneath and adjacent to the Thames Estuary and Marshes Ramsar site in Gravesham.	Land subject to permanent acquisition would potentially sterilise 14,500m ² (1.4ha) of safeguarded minerals. In line with Policies DM2, DM7 and DM9, prior extraction is unlikely to be supported or viable due to the potential adverse effects on the internationally designated Ramsar site, which is located north of Lower Higham Road. Viability of surface extraction is further compromised due to the thickness of Head Deposits and Alluvial that overlay the mineral resources. In light of the above, prior extraction is not therefore considered feasible and the Project would not result in the full sterilisation of any safeguarded mineral resources in Kent.
Thurrock Council	None identified	Thanet Formation (sand) River Terrace Deposits comprising Boyn Hill Gravel Member, Taplow Gravel Member, Lynch Hill Gravel Member Project ground investigation as presented in the Ground Model (Application Document 6.3, Appendix 10.5) indicate that mineral resources between the Muckingford Road and Stifford Clays Road are typically found close to the surface.	The Project would potentially result in 1.5 million m ² (150ha) of safeguarded minerals being sterilised. When put into context of the overall availability of safeguarded minerals within Essex and Thurrock, this would comprise 0.12% sterilisation. The Project proposals include a number of secured commitments to prioritise the use of prior extracted materials generated within the Order Limits, including MW007 and MW008 (Section 5.3). Mineral resources that are excavated within the MSA would be prioritised to be used within the Project. The areas of mineral sterilisation are likely to be discrete pockets in nature. The existing road network and access arrangements are likely to constrain the viability of mineral extraction, whilst the dispersed nature of the sterilised minerals would also reduce viability. Further

Mineral Authority	Allocated mineral extraction sites and infrastructure within Order Limits	Safeguarded minerals within Order Limits (land subject to permanent acquisition only)	Potential sterilisation within land subject to permanent acquisition
			<p>adverse environmental effects would likely arise due to:</p> <ul style="list-style-type: none"> • Reduction in road safety • Effects on local residential areas from noise, dust and air quality issues due to traffic movements and mineral workings • Loss of BMV land • Potential for cumulative effects from multiple site workings <p>The Project would not result in the full sterilisation of the Thanet Sands and River Terrace Deposits safeguarded mineral units for the following reasons:</p> <ul style="list-style-type: none"> • only a small amount of the relevant safeguarded minerals would be subject to potential sterilisation; • even then, the Project has secured commitments to reuse excavated materials and the nature of the geology means that some of these minerals will be reused in the Project; • full prior extraction is not a viable option for the reasons mentioned
Essex County Council	None identified	None identified within the Project Order Limits	No sterilisation of safeguarded minerals by the Project
London Borough of Havering	None identified	River Terrace Deposits comprising Boyn Hill Gravel Member and Lynch Hill Gravel Member	<p>Minimal sterilisation of safeguarded minerals by the Project would occur due to existing constraints limiting viability of mineral extraction, for example, the existing M25 and Thames Chase Forest Centre. Land subject to permanent acquisition would potentially result in 62,700m² (6.2ha) of safeguarded minerals to be sterilised.</p> <p>Within a large part of the areas sterilised by the Project to the west of the M25, the Project route is in cutting where it goes beneath the M25 and Ockenden Road. This would likely result in prior extraction of some of the minerals as part of the works and would reduce the effect reported.</p>

Mineral Authority	Allocated mineral extraction sites and infrastructure within Order Limits	Safeguarded minerals within Order Limits (land subject to permanent acquisition only)	Potential sterilisation within land subject to permanent acquisition
			<p>The Project proposals include a number of secured commitments to make preferential use of excavated materials generated within the Order Limits, including MW007 and MW008 (Section 5.3).</p> <p>The Project would not result in the full sterilisation of the Boyn Hill Member safeguarded mineral units.</p>

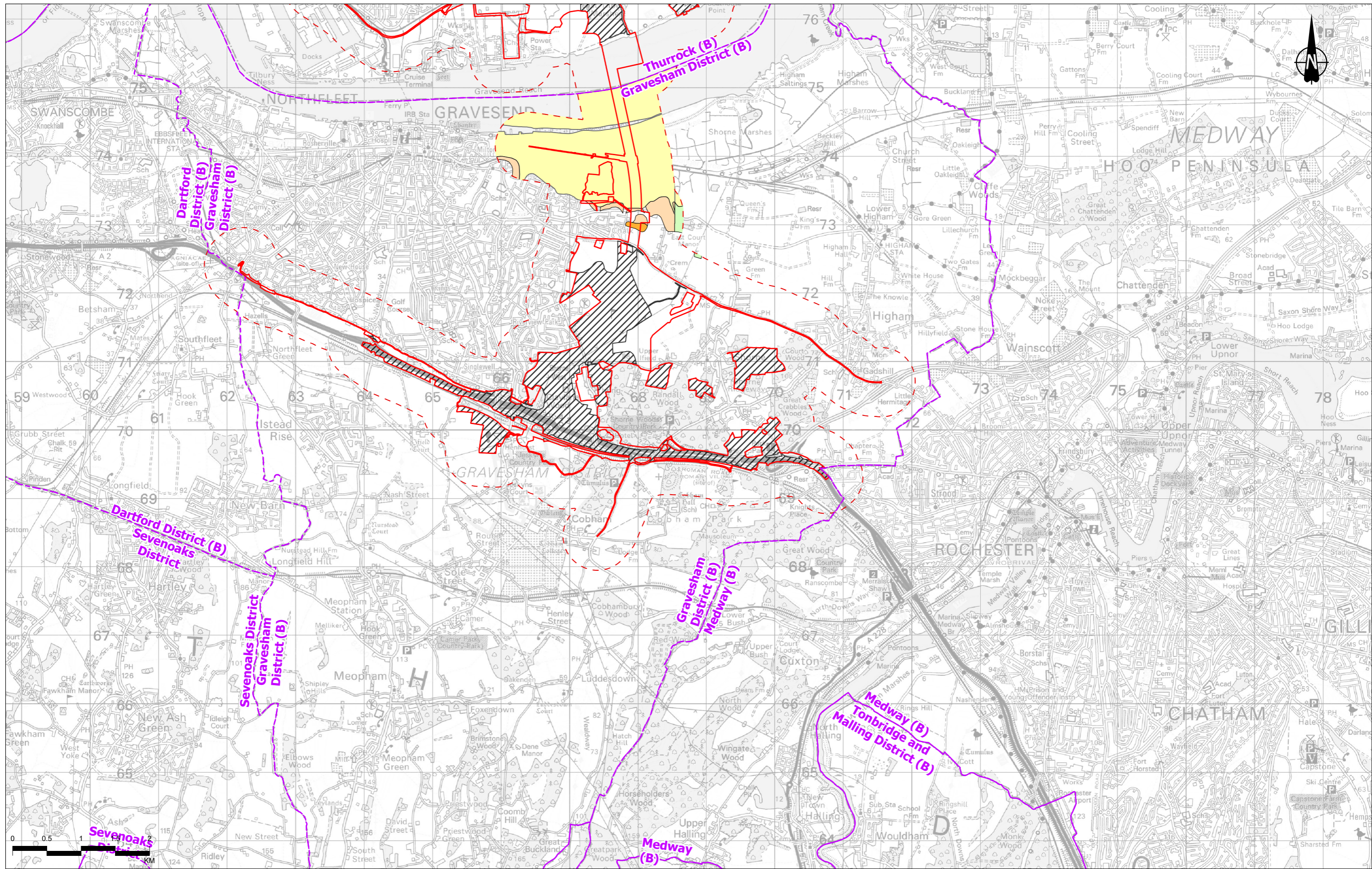
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Figures

Figure number	Figure name
1	Mineral Safeguarding Area Baseline
2	Existing mineral extraction constraints
3	Potential Mineral Sterilisation

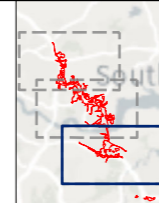
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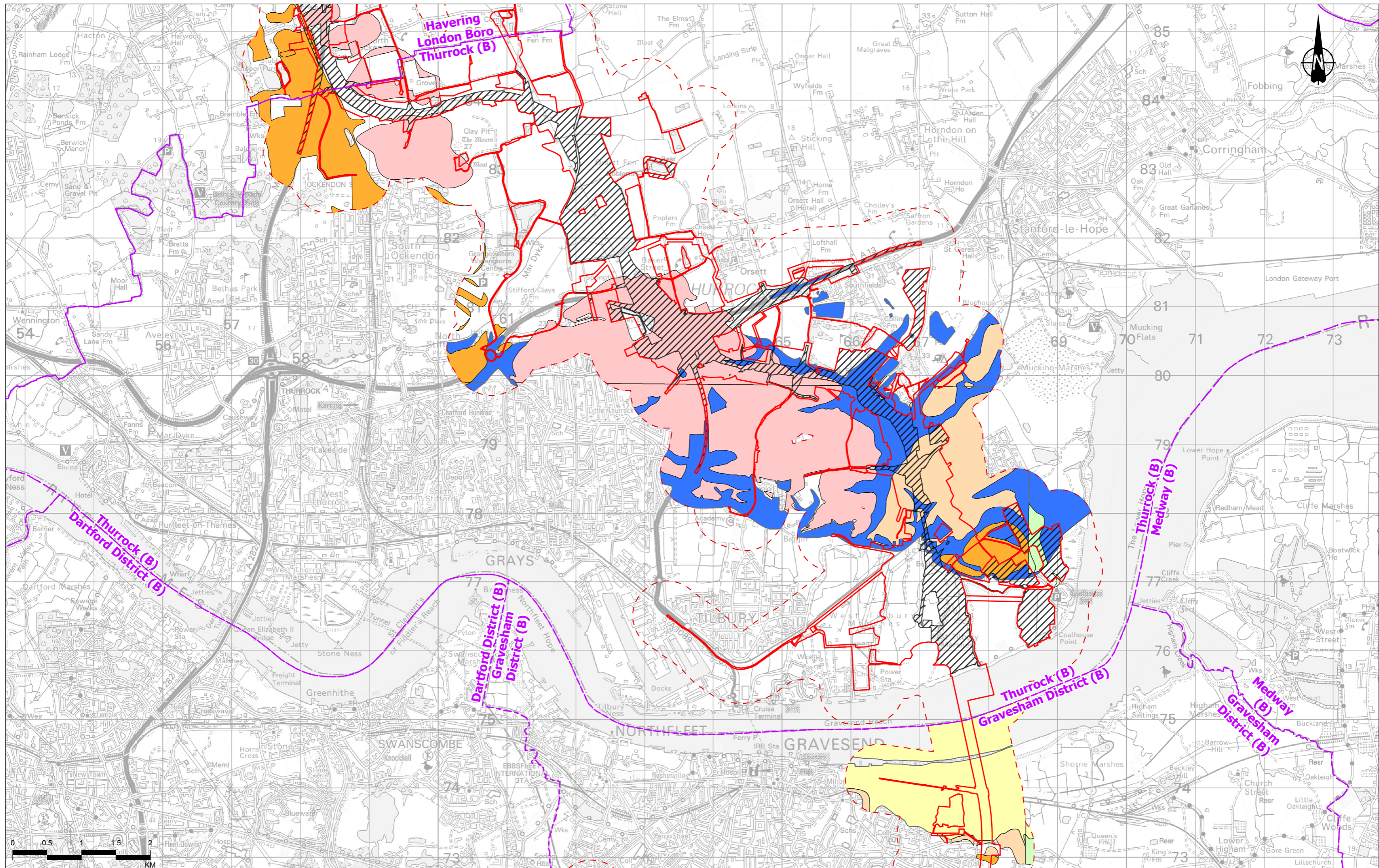
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Rev	Status	Rev. Date	Purpose of revision	Drawn	Checked	Approved

	Order Limits		Lynch Hill Gravel Member - Sand and gravel
	500m buffer for Order Limits		Taplow Gravel Formation - Sand and gravel
	District/Borough Unitary Region		River Terrace Deposits
	Permanent Acquisition of Land		Alluvium - Clay, silt, sand and peat



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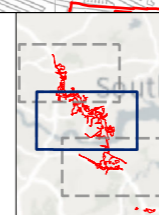
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Drawing Title	Figure 1: Mineral Safeguarding Area				
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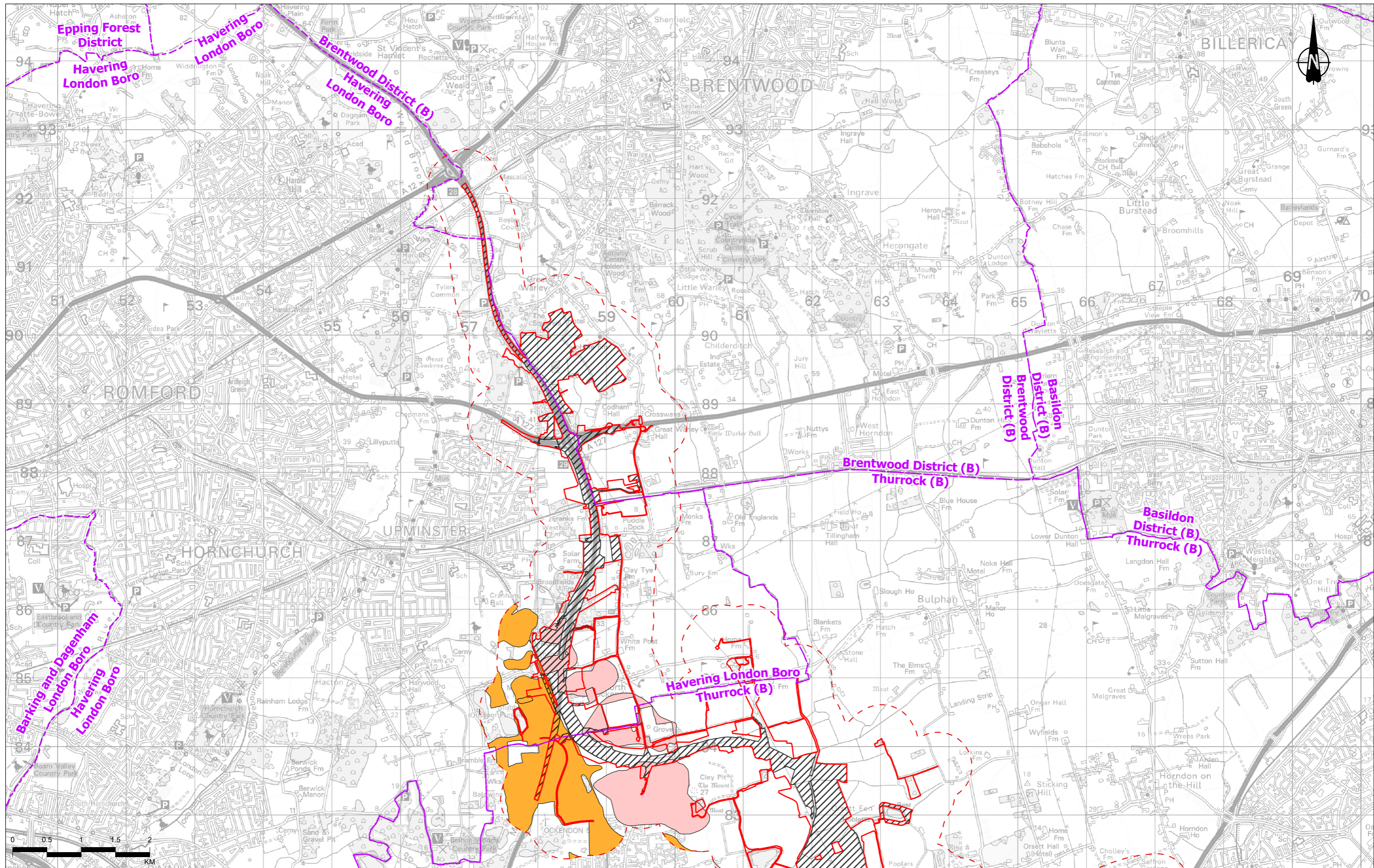
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P01	S8	23/08/2022	DCO Application	CD	SC	MW

Legend	
	Order Limits
	500m buffer for Order Limits
	District/Borough Unitary Region
	Permanent Acquisition of Land
	Lynch Hill Gravel Member - Sand and gravel
	Taplow Gravel Formation - Sand and gravel
	Boyn Hill Gravel Member - Sand and gravel
	River Terrace Deposits
	River Terrace Deposits, 2 - Sand and gravel
	River Terrace Deposits (Undifferentiated) - Clay and silt
	Alluvium - Clay, silt, sand and peat
	Thanet Formation - Sand, silt and clay



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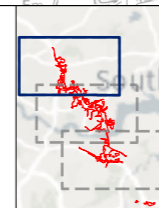
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Rev	Status	Rev. Date	Purpose of revision	Drawn	Chkd	Apprvd
P01	S8	23/08/2022	DCO Application	CD	SC	MW

- Legend**
- Order Limits
 - 500m buffer for Order Limits
 - District/Borough Unitary Region
 - Permanent Acquisition of Land
 - Lynch Hill Gravel Member - Sand and gravel
 - Boyn Hill Gravel Member - Sand and gravel

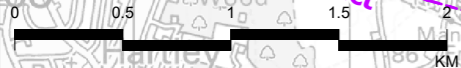
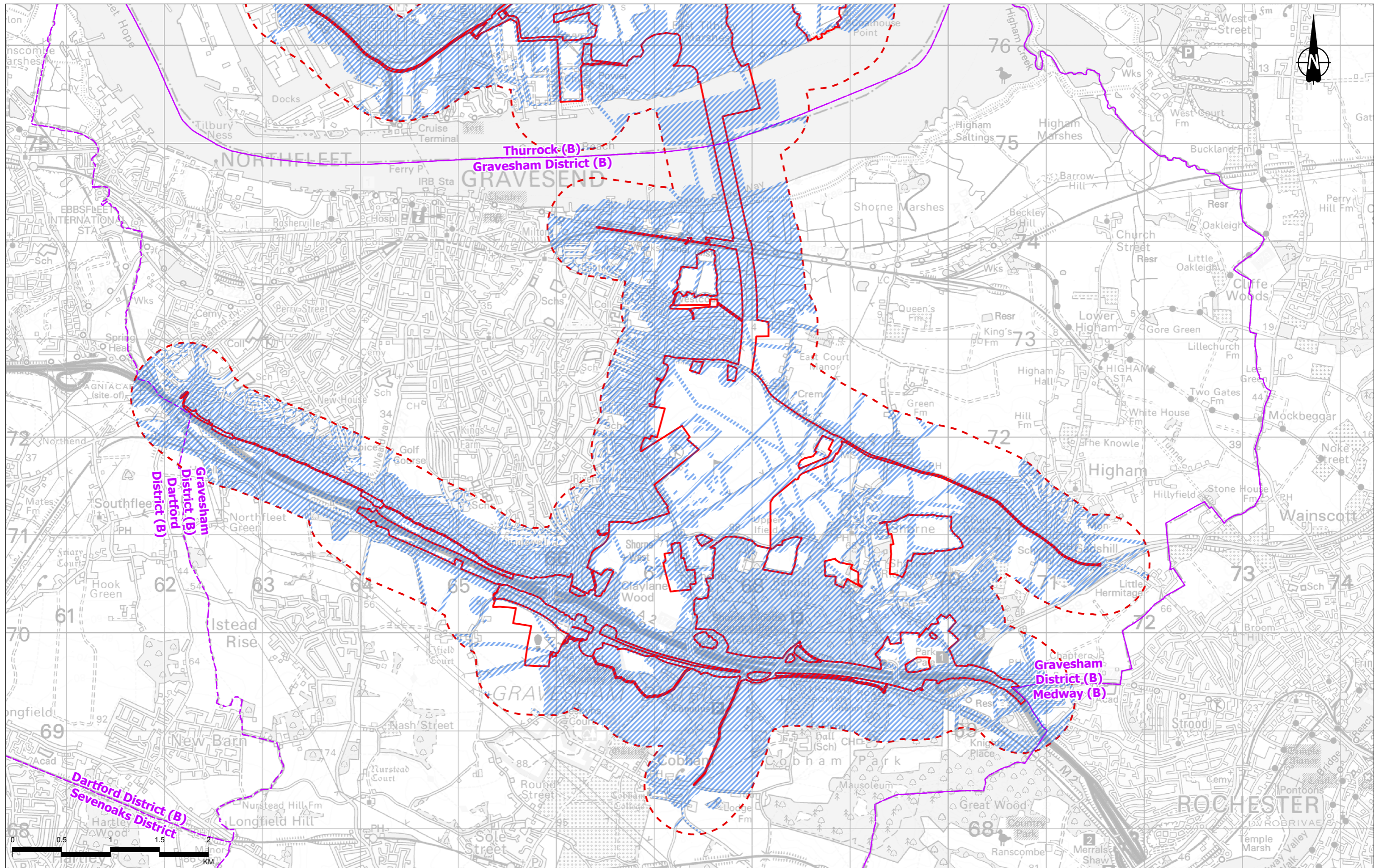


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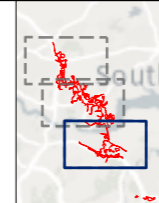
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Baseline Page 3 of 3



- Legend**
- Order Limits
 - 500m buffer for Order Limits
 - District/Borough Unitary Region
 - Development constraints

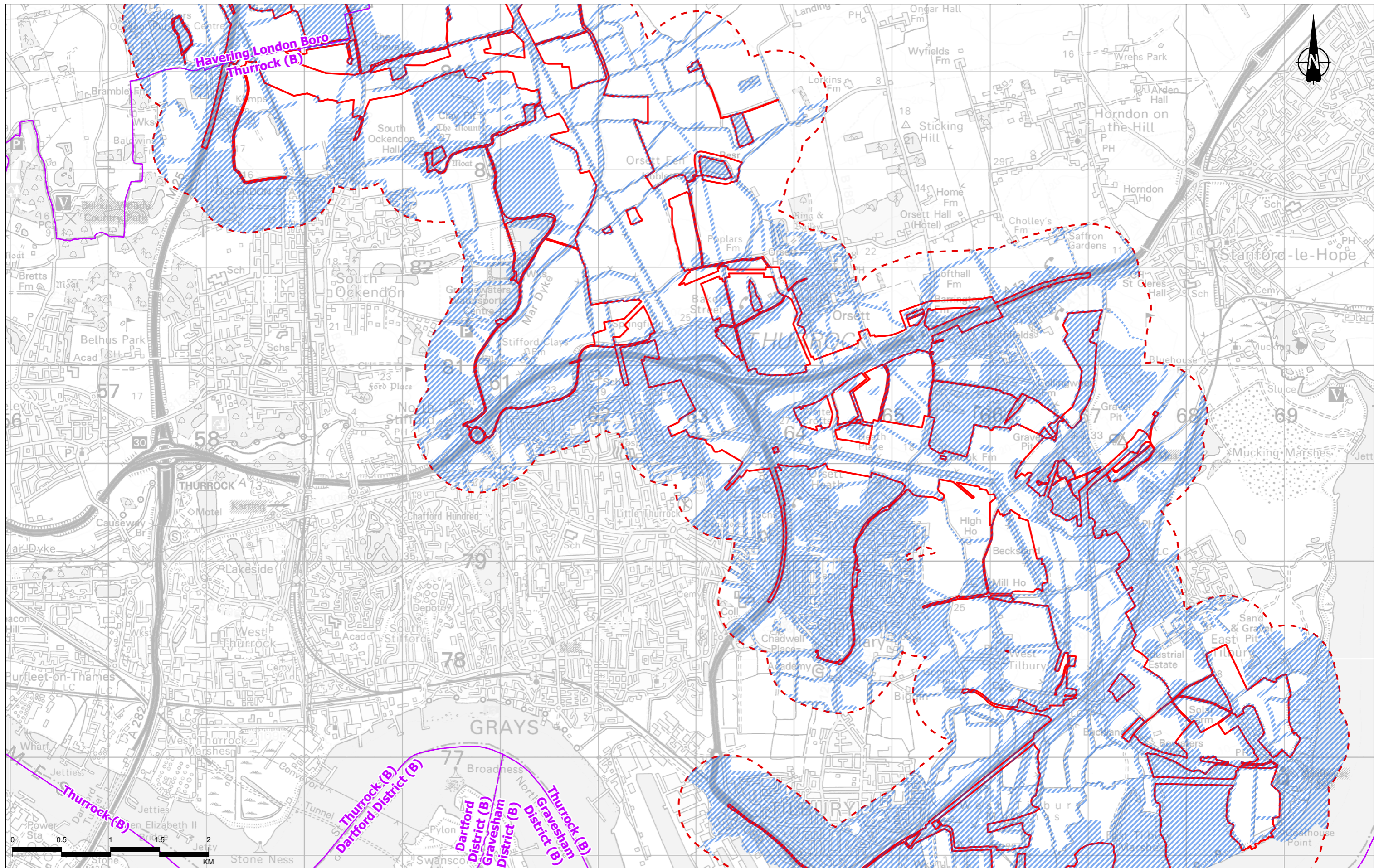


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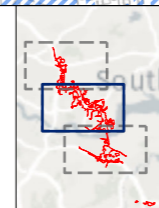


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- Order Limits
- 500m buffer for Order Limits
- District/Borough Unitary Region
- Development constraints



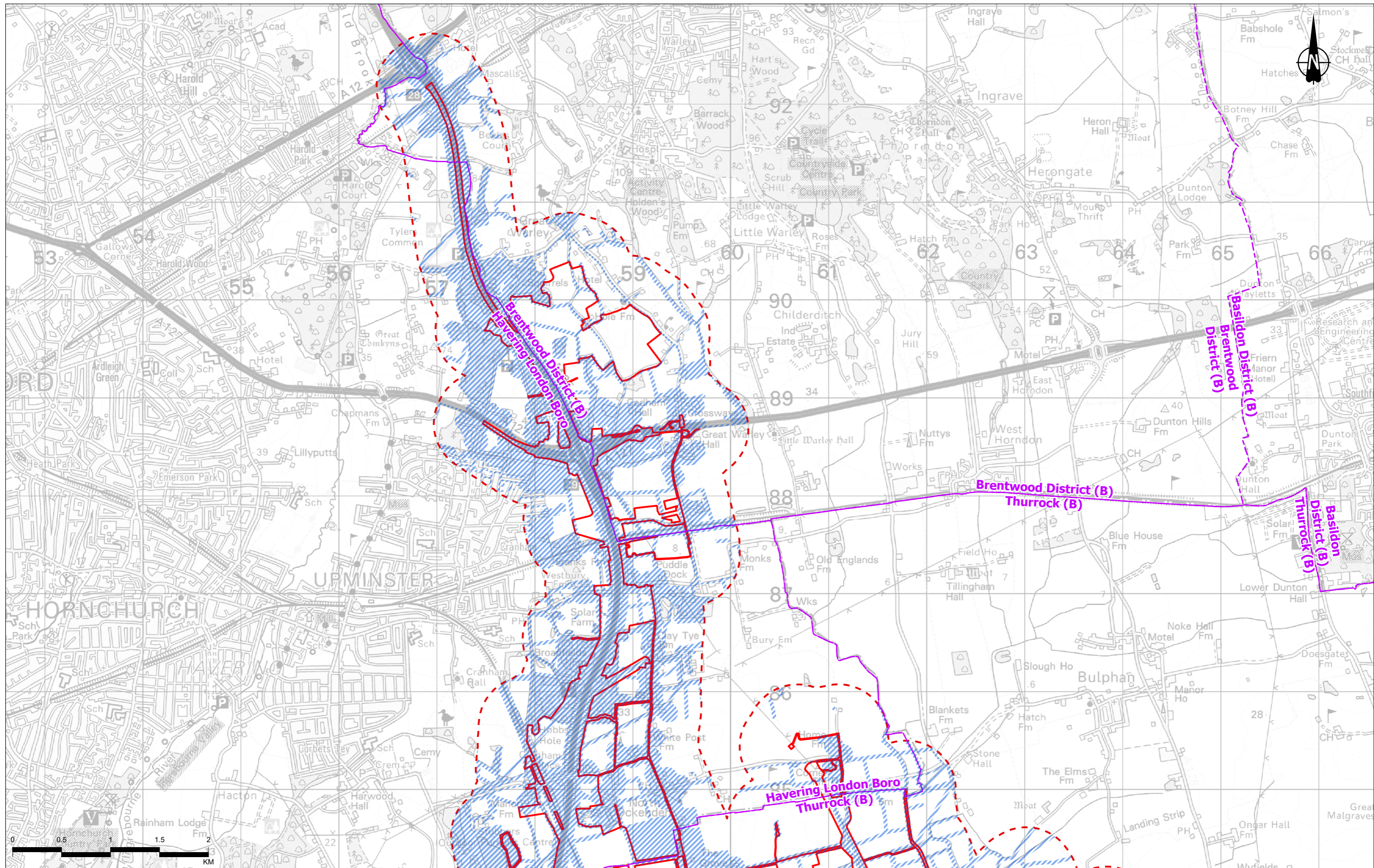
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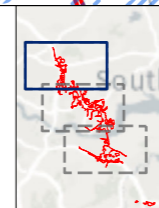


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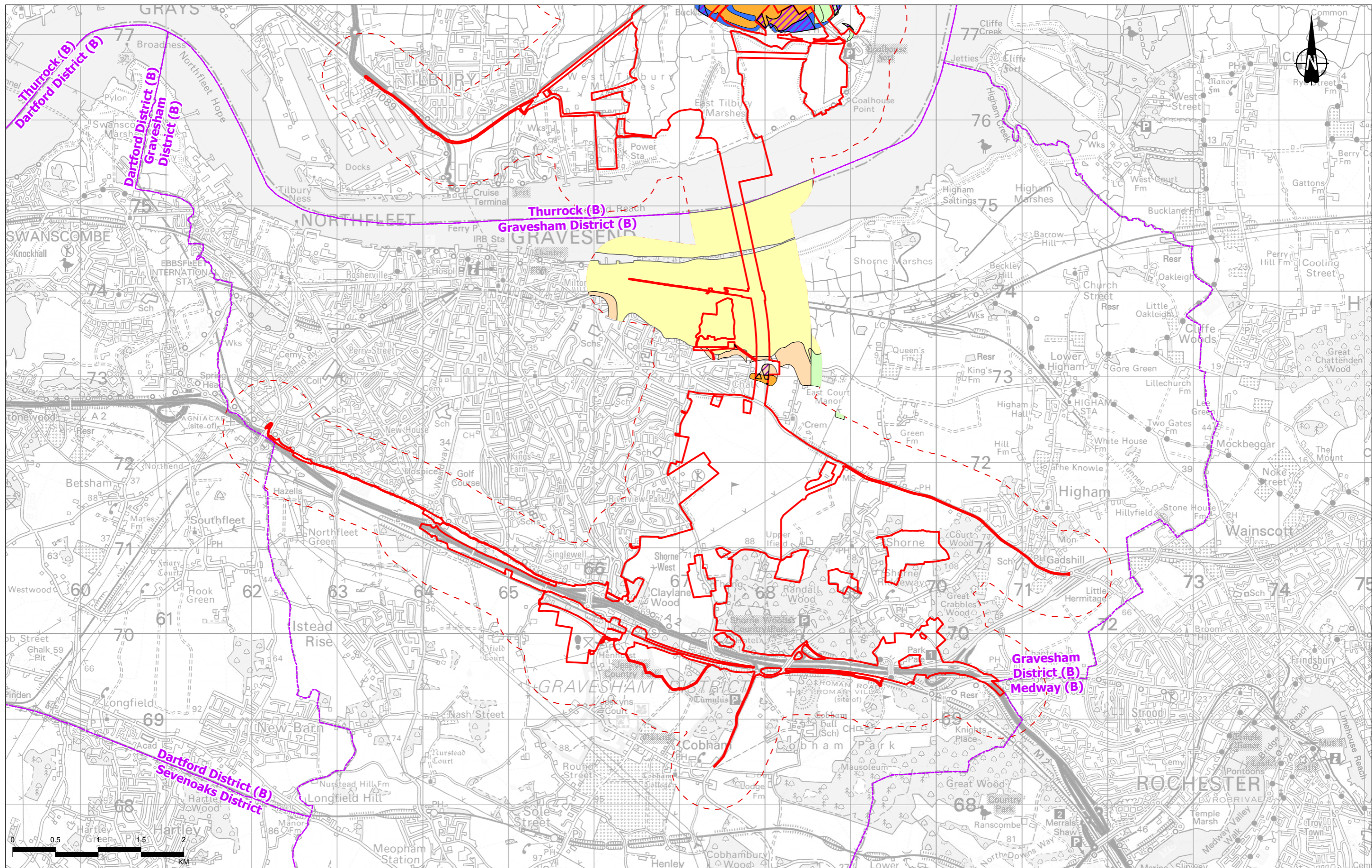
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Drawing Number	HE540039-CJV-EGN-SZP_EGNE0000000-DR-LE-10002				

Page 3 of 3

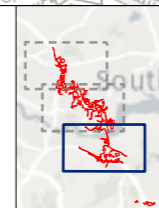
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P01	S8	9/5/2022	DCO Application	CD	SC	MW
Rev	Status	Rev. Date	Purpose of revision	Drawn	Chkd	Apprvd

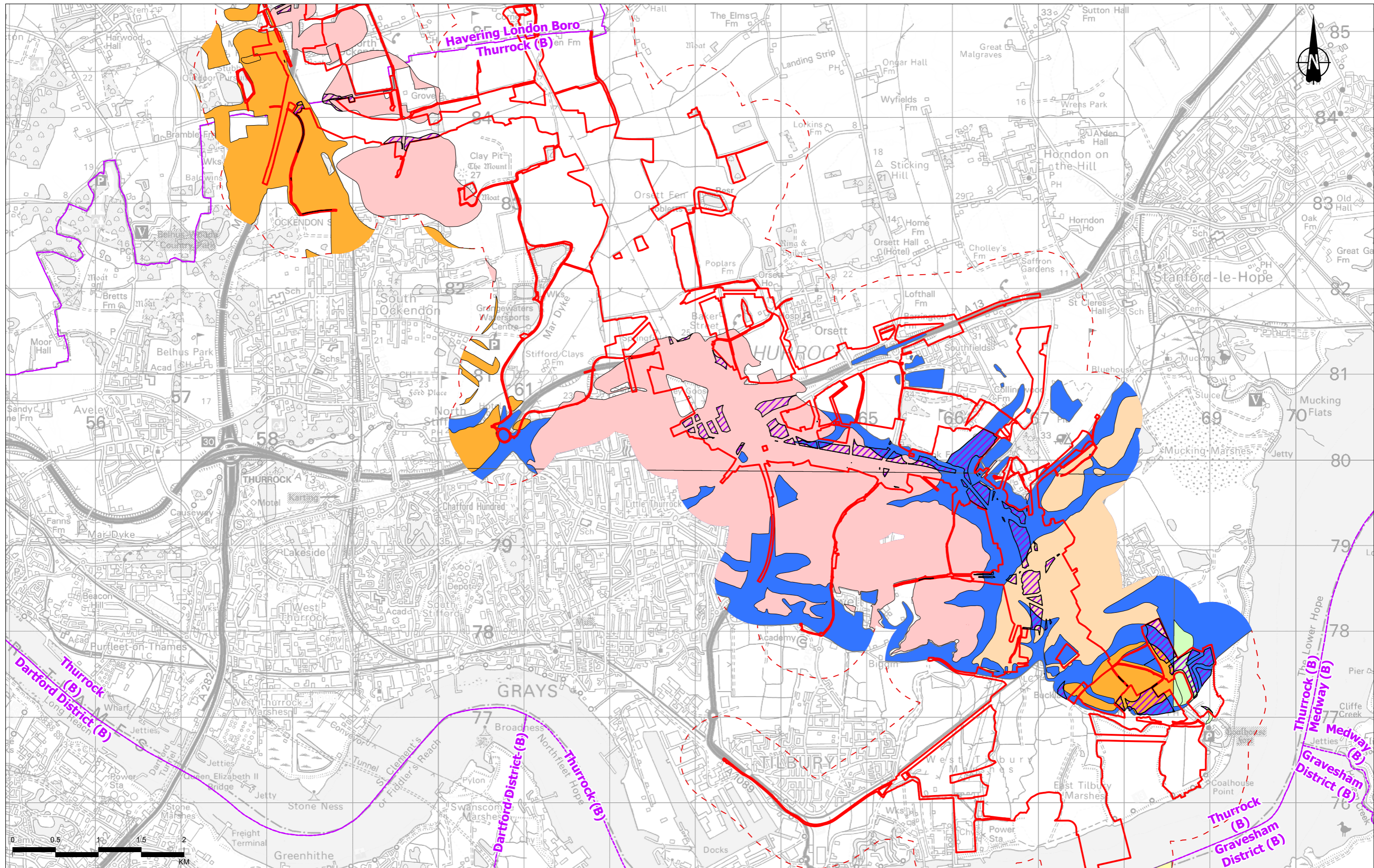
Legend	
	Order Limits
	500m buffer for Order Limits
	District/Borough Unitary Region
	Areas of potential sterilisation
	Alluvium - Clay, silt, sand and peat
	Thanet Formation - Sand, silt and clay
	Lynch Hill Gravel Member - Sand and gravel
	Taplow Gravel Formation - Sand and gravel
	River Terrace Deposits, 1 - Sand and gravel
	River Terrace Deposits, 2 - Sand and gravel
	River Terrace Deposits (Undifferentiated) - Clay and silt



Client: national highways

Project: LOWER THAMES CROSSING

Status	DCO APPLICATION	Original Size	A3	Revision	P01
Application Document Number	TR010032/APP/6.3	Scale	1:40,000		
Drawing Title	Figure 3: Potential Mineral Sterilisation Kent				
Drawing Number	HE540039-CJV-EGN-SZP_EGNE0000000-DR-LE-10003				
Page 1 of 3					

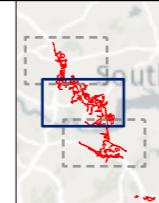


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P01	S8	9/5/2022	DCO Application	CD	SC	MW
Rev	Status	Rev. Date	Purpose of revision	Drawn	Chkd	Apprvd

- Legend**
- Order Limits
 - 500m buffer for Order Limits
 - District/Borough Unitary Region
 - Areas of potential sterilisation

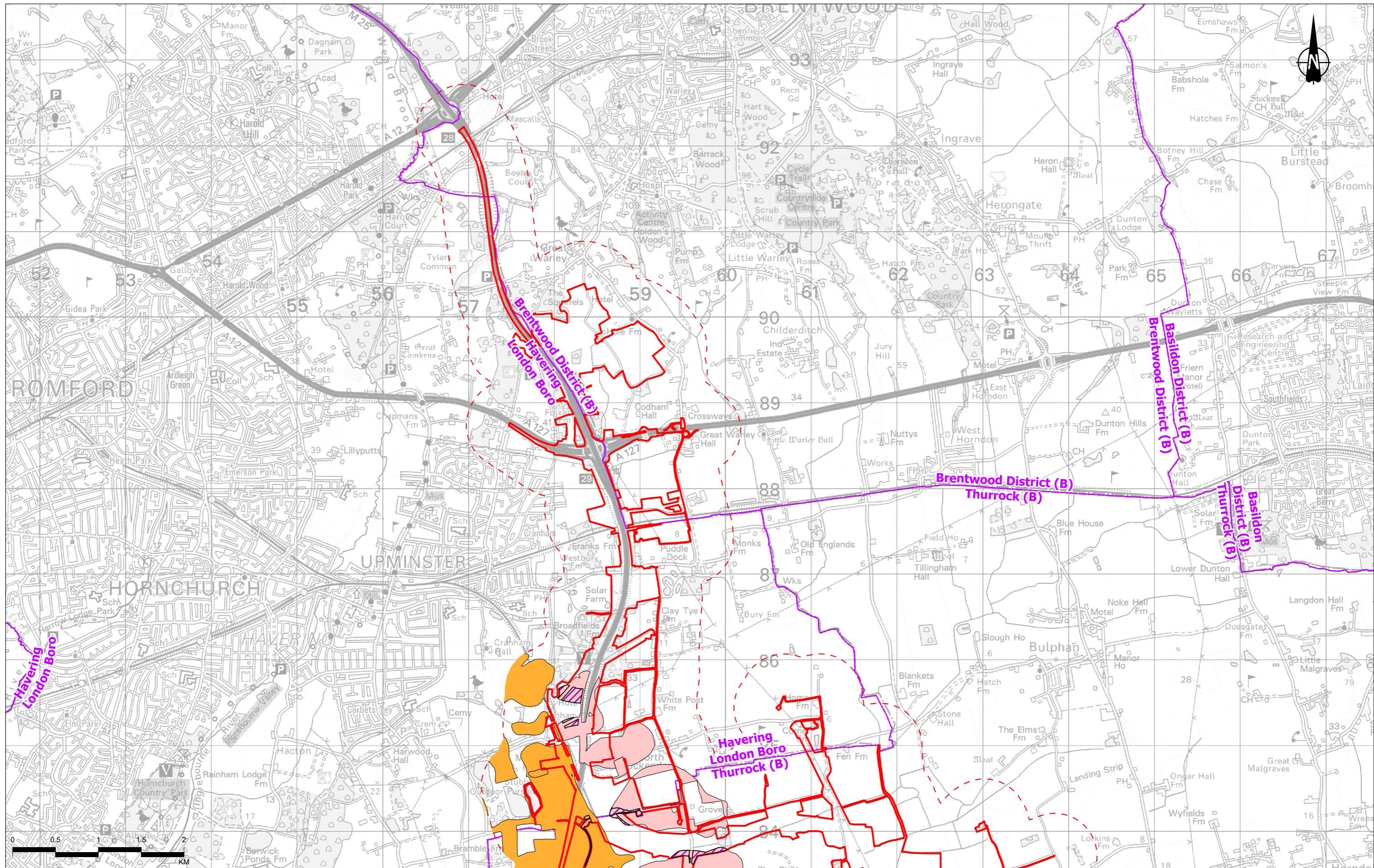
- Alluvium - Clay, silt, sand and peat
- Thanet Formation - Sand, silt and clay
- Boyn Hill Gravel Member - Sand and gravel
- River Terrace Deposits, 2 - Sand and gravel
- Lynch Hill Gravel Member - Sand and gravel
- River Terrace Deposits (Undifferentiated) - Clay and silt
- Taplow Gravel Formation - Sand and gravel



Client
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Project
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Status	DCO APPLICATION	Original Size	A3	Revision	P01
Application Document Number	TR010032/APP/6.3	Scale	1:40,000		
Drawing Title	Figure 3: Potential Mineral Sterilisation Thurrock				
Drawing Number	HE540039-CJV-EGN-SZP_EGNE0000000-DR-LE-10003				
Page 2 of 3					

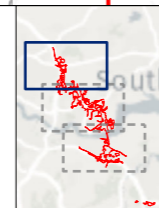


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Rev	Status	Rev. Date	Purpose of revision	Drawn	Chkd	Apprvd
P01	S8	9/5/2022	DCO Application	CD	SC	MW

Legend

- Order Limits
- 500m buffer for Order Limits
- District/Borough Unitary Region
- Areas of potential sterilisation
- Lynch Hill Gravel Member - Sand and gravel
- Boyn Hill Gravel Member - Sand and gravel



Client
national highways

Project
LOWER THAMES CROSSING

Status	DCO APPLICATION	Original Size	A3	Revision	P01
Application Document Number	TR010032/APP/6.3	Scale	1:40,000		
Drawing Title	Figure 3: Potential Mineral Sterilisation Havering				
	Page 3 of 3				
Drawing Number	HE540039-CJV-EGN-SZP_EGNE0000000-DR-LE-10003				

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