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The London Resort Company Holdings Limited

The London Resort

Environmental Statement

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Appendix 14.4

London Resort

Desk-Based Assessment and Statement of
Archaeological Significance (Palaeolithic) for
main access road (eastern route), and
people-mover tram/cycle route options



**London Resort
Springhead, Kent**

**Desk-Based Assessment and Statement of Archaeological Significance
(Palaeolithic) for main access road (eastern route), and people-mover
tram/cycle route options**

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London Resort Springhead, Kent

Desk-Based Assessment and Statement of Archaeological Significance (Palaeolithic) for main access road (eastern route), and people-mover tram/cycle route options

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London Resort Springhead, Kent

Desk-Based Assessment and Statement of Archaeological Significance (Palaeolithic) for main access road (eastern route), and people-mover tram/cycle route options

Summary

Wessex Archaeology was commissioned by London Resort Company Holdings (LRCH) to prepare a Palaeolithic Desk-Based Assessment of the people mover bridge/tunnel and tram/cycle route options for London Resort, Springhead, Kent. The relevant part of the Project Site is centred on National Grid Reference (NGR) 561241, 174202.

This report has been prepared at the request of curatorial authorities (Historic England, Natural England and Kent County Council) to help inform decision-making concerning the proposed London Resort in the Ebbsfleet valley and Swanscombe peninsula. The main focus of the report is to provide a Palaeolithic Desk-based Assessment (DBA) and Statement of Significance for areas of higher Palaeolithic potential in the central part of the proposed resort site, where the main access road and various people-mover cycle/tram route options pass through the Baker's Hole Palaeolithic Site designated Scheduled Monument and Site of Special Scientific Interest.

The report provides a DBA and Statement of Significance for the main access road (eastern route), and also provides a comparison for three cycle/tram people-mover route options of their impact upon areas of Palaeolithic potential. The routes and route options addressed in this DBA are:

- The footprint of the main access road (eastern route) route shown as "tunnel/bridge" in yellow on the issued scoping plans (**Figures 1, 4, 5**)
- the footprint of Option 1 for a combined cycle/tram people-mover route shown in blue and light green on the issued scoping plans (**Figures 1, 4, 5**)
- the footprint of Option 2 of a combined cycle/tram people-mover route shown in brown on the issued scoping plans (**Figure 6**)
- the footprint of Option 3 of a combined cycle/tram people-mover route shown in purple, based on a meeting with curatorial authorities and LRCH held at Savills, 33 Margaret Street, London on 24th July 2017 (**Figure 7**)

All of these route options have impacts upon areas of high Palaeolithic potential. No alternative options were presented for the main access road (eastern route), which passes through areas of MODERATE , HIGH and VERY HIGH potential (areas PP13, PP15 and PP07 respectively). It would be necessary to carry out field evaluation of the parts of the route that pass through these areas to clarify their potential.

For the three options presented for the cycle/tram route, it is clear that Option 2 has a significantly lesser impact upon Palaeolithic remains. However, if this option is impossible, then Option 3 seems more viable than Option 1 from a heritage impact perspective.



All of Options 1, 2 and 3 pass through areas of MODERATE and HIGH potential (areas PP 13 and PP15a respectively) in their shared southern half. Beyond that, the northern part of Option 2 passes through areas of LOW or NONE potential, apart from through a short stretch of the eastern end of PP 04 which has been characterised as of MODERATE potential.

In contrast, the northern half of Option 1 passes north-south through the entire length of the VERY HIGH potential area PP07. Furthermore, it cuts between Site A and ZR4, and thus would compromise the future possibility of any investigation of the direct lithostratigraphic relationship between the deposits at Site A and those at ZR4. The particular difficulty with this option is that it is not possible without major prior field evaluation to establish where exactly the most significant deposits are located.

If Option 2 is unachievable, Option 3 is preferable to Option 1. Although it likewise passes north-south through the VERY HIGH potential area PP07, it passes down the west side of this area, avoiding the transitional zone between Site A and ZR4. The deposits along the west side have only been minimally investigated to date, but they have been broadly surveyed and their character and depth are known. Therefore it is possible with a high degree of confidence to develop a moderate-scale programme of targeted fieldwork that would (subject to approval by the relevant curatorial authorities) provide adequate mitigation for any impact of this route option.



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Desk-Based Assessment and Statement of Archaeological Significance (Palaeolithic) for main access road (eastern route), and people-mover tram/cycle route options

Acknowledgements

The project was commissioned by London Resort Company Holdings and Wessex Archaeology is grateful to them in this regard. Thanks are also extended to Dr Francis Wenban-Smith (Department of Archaeology, University of Southampton).

The report was written by Dr Francis Wenban-Smith with illustrations prepared by Francis Wenban-Smith and Andrew Souter. The project was managed on behalf of Wessex Archaeology by Mark Williams.



London Resort Springhead, Kent

Desk-Based Assessment and Statement of Archaeological Significance (Palaeolithic) for main access road (eastern route), and people-mover tram/cycle route options

1 INTRODUCTION

1.1 Project circumstances and scope of report

- 1.1.1 Wessex Archaeology was commissioned by London Resort Company Holdings (LRCH) to prepare a Palaeolithic Desk-Based Assessment of the main access road (eastern route) and three people-mover tram/cycle route options for the proposed London Resort, Springhead, Kent, where they pass through the Baker's Hole Palaeolithic Site designated Scheduled Monument and Site of Special Scientific Interest. The area under consideration is centred on National Grid Reference (NGR) 561200 174150.
- 1.1.2 This report comprises a Palaeolithic Desk-based Assessment (DBA) for a small part of the overall development area for the proposed Paramount London Entertainment Resort [henceforth, "the Resort"]. This DBA has been prepared in response to a specific request from the curatorial authorities - Historic England, Natural England, and Kent County Council - concerned with considering the impact of the Resort upon the historic and natural environment. This report has been prepared by the Palaeolithic specialist Francis Wenban-Smith (Department of Archaeology, University of Southampton) working with Wessex Archaeology London and South-East.
- 1.1.3 The request was initially made at a scoping meeting held at Wessex Archaeology (Maidstone offices) on 19th October 2016, concerning possible route options for the main access road and people-mover tram/cycle routes between a new exit off the A2 and the main Resort area on the Swanscombe peninsula. These route options were liable to affect designated nationally important Palaeolithic remains and Pleistocene deposits comprising the Baker's Hole Scheduled Monument and Site of Special Scientific Interest, as well as adjacent non-designated deposits of similar importance. The DBA area was defined as comprising the area of these designated remains (**Figure 1**).
- 1.1.4 The four routes and route options addressed in this DBA are:
- the footprint of the main access road (eastern route) route shown as "tunnel/bridge" in yellow on the issued scoping plans (**Figures 1, 4, 5**)
 - the footprint of Option 1 for a combined cycle/tram people-mover route shown in blue and light green on the issued scoping plans (**Figures 1, 4, 5**)
 - the footprint of Option 2 of a combined cycle/tram people-mover route shown in brown on the issued scoping plans (**Figure 6**)
 - the footprint of Option 3 of a combined cycle/tram people-mover route shown in purple, arising from the meeting with curatorial authorities and LRH held at Savills, 33 Margaret Street, London on 24th July 2017 (**Figure 7**)



- 1.1.5 Some specific questions that this DBA is intended to address were specified in this meeting and in subsequent instruction [email from Peter Kendall, sent 15th June 2017 16:17, on behalf of the combined relevant curatorial authorities] as:
- Statement of Significance of deposits affected by the various route options
 - research questions to which the affected deposits are relevant
 - the information contained in the deposits that helps address these questions
 - consideration of whether these questions can be otherwise addressed
 - "knowns and unknowns"
 - broad advice on suitable methods of field investigation
- 1.2 The Site**
- 1.2.1 The overall area of the proposed Resort covers several square km in the vicinity of Swanscombe, Kent, mostly north of the A2 and west of HS1. The part of the Resort area under consideration for this DBA is located in the Ebbsfleet valley, immediately to the west of Ebbsfleet International station, centred on NGR 561200 174200 (**Figure 1**).
- 1.2.2 From an archaeological viewpoint, the area under consideration corresponds with a complex of Palaeolithic sites that have become broadly known as "Baker's Hole" and the "Ebbsfleet Channel". These names are, however, often used imprecisely for the numerous and varied deposits and remains from different parts of the site.
- 1.3 Methods and sources**
- 1.3.1 The main method employed in preparation of this DBA has been reference to published and unpublished primary data and secondary syntheses concerning field investigations and archaeological discoveries in the study area since the 19th century. There is a long history of archaeological investigation (especially of Palaeolithic remains) that starts in the late 19th century, and continues through to the present day. This has been supplemented by reference to geological and historical mapping.
- 1.3.2 Specific primary sources are quoted when relevant in the text, but more-generic and secondary sources that have informed this DBA are:
- Geological 1:50,000 Solid and Drift mapping for the area (British Geological Survey 1998), accompanying interpretive memoirs for this sheet (Dewey *et al.* 1924; Ellison 2004), and historic geological mapping at 6" to one mile (Kent Sheet X, NW)
 - historic OS mapping, surveys done in 1865, 1895, 1907, 1938, 1954, 1961, 1974, 1980s, 1990s and pre-HS1 in the early 2000s
 - J Wymer's synthesis of Lower/Middle Palaeolithic sites along the Thames Valley (Wymer 1968)
 - grey literature held by Kent County Council relating to recent work in the study area, in particular that carried out by Oxford Wessex Archaeology in conjunction with HS1
 - field data from PhD research by F Wenban-Smith, carried out between 1989 and 1994 (Wenban-Smith 1996)
- 1.3.3 The data from these sources has been used to create a "virtual landscape" of Palaeolithic character and potential. The data was collated to firstly identify areas where natural deposits survive, and then to characterise these areas in terms of their deposit character and Palaeolithic potential, and to define key areas of greater Palaeolithic potential. This virtual landscape forms the primary output of this DBA (**Figure 1**;



Appendix 1). The key Palaeolithic areas have been given unique identifiers prefixed by "PP", and these numbered areas retain the same numbers as from other outputs previously produced (or in current preparation) for the wider Resort area.

- 1.3.4 The various route options have been overlain onto this virtual landscape of Palaeolithic character/potential, and separate appendices (**Appendices 2, 3, 4**) and figures (**Figures 1, 6, 7**) have been prepared, which divide the route options into zones of different character/potential. These zones sometimes map directly onto the "PP" areas (explained above), but some parts of these routes cross zones that have not been attributed to a zone of higher Palaeolithic potential, and information is also given about these zones in the relevant appendices.

2 ARCHAEOLOGICAL BACKGROUND

2.1 Landscape, geology and the Palaeolithic

Geological background and general Palaeolithic introduction

- 2.1.1 The main Ebbsfleet valley cuts northward from Springhead to the south side of the Thames estuary through Chalk bedrock and the major east-west trending Boyn Hill/Orsett Heath Pleistocene fluvial terrace formation, which runs here above (and broadly parallel with) the south side of the Thames between Dartford and Gravesend. Thus the high ground on the east and west flanks of the Ebbsfleet valley consists of older Middle Pleistocene terrace deposits, whereas the Ebbsfleet Valley has cut through these deposits and is infilled with younger sediments.

- 2.1.2 The Ebbsfleet Valley and its environs has been a key area for Palaeolithic research for over a hundred years. Palaeolithic sites in the area form three main groups. Firstly, and earliest, are Lower Palaeolithic sites associated with the Boyn Hill/Orsett Heath terrace formation. These deposits were laid down during the Hoxnian interglacial (Bridgland 1994), a period of warm climate lasting from c. 425,000 to 350,000 BP [years Before Present]. Secondly, and slightly younger, are Middle Palaeolithic sites associated with sediments filling the Ebbsfleet Valley, and dating from c. 250,000 to 150,000 BP (Wenban-Smith 1995). And thirdly, and much younger, are Late Upper Palaeolithic sites dating to c. 12,000 BP associated with Late Glacial slopewash sediments, which have infilled various dry valleys that cut down across the present-day topography

Lower Palaeolithic

- 2.1.3 The Boyn Hill/Orsett Heath Formation is preserved on the south side of the Lower Thames as an intermittent east–west trending band from Dartford Heath through Dartford, Stone, Greenhithe and Swanscombe to Northfleet. The deposits consist of a sequence of predominantly fluviatile loam, sand and gravel units. This stretch is rich in significant Lower Palaeolithic archaeological remains. Quarrying and archaeological research have produced flint artefacts, faunal remains and other biological evidence relating to climate and environment at numerous locations (Wymer 1968; Wessex Archaeology 1993).
- 2.1.4 The best-investigated site is the Barnfield Pit, Swanscombe c. 1km to the west of the Ebbsfleet Valley (Ovey, *ed.* 1964; Conway *et al.* 1996). This is recognised as a site of international archaeological significance, as well as being designated an SSSI on Quaternary geological grounds and a National Nature Reserve.



2.1.5 For the purposes of this DBA, it is worth recapping the evidence from Barnfield Pit, since the same terrace sequence continues into the west side of the DBA area (west end of PP 04). The sequence at Barnfield Pit contained lithic and faunal remains incorporated in stratified fluvial sand and gravel units, accompanied by biological palaeo-environmental evidence (**Table 1**). Undisturbed archaeological horizons preserving intact evidence of Lower Palaeolithic activity were present in one of the lower deposits — the Lower Loam. And one horizon within the middle phase of the Barnfield Pit sequence — the Upper Middle Gravel — has also produced an early human fossil skull (the Swanscombe Skull) making it one of only two sites in England with Lower or Middle Palaeolithic hominid skeletal evidence

Phase	OI Stage	Stratigraphic unit	Height OD	Palaeolithic archaeology
III	11–10/ 10/ 10–8?	Upper Gravel	c. 33–34m	Occasional ovate handaxes, often with twisted profiles and tranchet sharpening, debitage — "Acheulian"
		Upper Loam	c. 32–33m	
		Upper Sand	c. 29.5–32m	None known
II	11	Upper Middle Gravel	c. 28.5–32m	Pointed handaxes with thick partly trimmed butts (often large and well-made but also small and crude), cores, debitage and <i>ad hoc</i> flake-tools — "Acheulian" (Swanscombe Skull level)
		Lower Middle Gravel	c. 26.5–28.5m	
I	11	Lower Loam	c. 25–26.5m	Cores, debitage, <i>ad hoc</i> flake tools, and very occasional crude proto-handaxes — "Clactonian"
		Lower Gravel	c. 22–26.5m	

Table 1: Stratigraphic and archaeological summary of Barnfield Pit sequence, Swanscombe

Middle Palaeolithic

2.1.6 The deposits that once filled the Ebbsfleet Valley [before the major quarrying activity of the late 19th and 20th centuries] have produced significant quantities of Middle Palaeolithic material. These deposits comprised a mixture of fluvial, colluvial and solifluction deposits that were mostly at elevations of between 5m and 15m OD. The fluvial deposits were laid down by ancient courses of the Ebbsfleet, cutting northward towards the Thames, and can mostly be related to marine isotope stage (MIS) 7, dating to between 240,000 and 190,000 BP (Bridgland 1994; Wenban-Smith 1995). And there are also solifluction/slopewash deposits of broadly similar age that partly underlie, partly overlie, and are partly interdigitated with the fluvial beds; these also contain rich Middle Palaeolithic remains in places, in particular a distinctive lithic technology associated with early Neanderthals that is called "Levalloisian" after the Paris suburb of Levallois-Perret where it was first recognised.

2.1.7 The Ebbsfleet valley deposits have produced unique records in Britain of abundant well-provenanced Levalloisian lithic remains associated with deposits rich in a range of faunal remains, allowing the Levalloisian occupation to be reliably dated to early in MIS 7, c. 250,000 BP. The Levalloisian occupation horizons are situated within a deep sequence of deposits, which provide a wider Quaternary context for this occupational episode, and facilitate correlation with other key sites in the region, as well as nationally and internationally.

2.1.8 The surviving deposits in the DBA area are of particular importance as the only locality in Britain (and indeed perhaps Europe, or even globally) where deposits are known to be



present that represent three distinct episodes of interglacial warmth with woodland development that can all be linked to the MIS 7 interglacial. This complex interglacial is known to have three distinct warm peaks, but it has only recently been recognised - in work soon to be published as part of the High Speed 1 archaeology programme (Wenban-Smith *et al.* in press for 2017) - that all three of these peaks are associated with development of woodland, and that all have distinct biostratigraphic signatures. In particular each warm peak is accompanied by distinctive small vertebrate assemblages.

- 2.1.9 Thus the deposits in the DBA area are of crucial importance in establishing a framework within which to understand Palaeolithic and palaeo-environmental remains from other MIS 7 localities, where only one, or sometimes two, interglacial episodes are represented: for instance at Aveley and Crayford, other nationally important localities in the Lower Thames basin. The surviving deposits at the site are also important in retaining high potential for further improving understanding of MIS 7, since they contain faunal remains that can be used for palaeo-environmental reconstruction and biostratigraphic dating, as well as molluscan remains that can be used for amino acid dating. The sediments themselves are also predominantly sand-rich, and thus have potential for OSL dating.
- 2.1.10 Further details of key Middle Palaeolithic discoveries in the Ebbsfleet valley are given below (**Section 2.3**), since they are heavily bound up with this DBA and the impact on the historic environment of the various route options under consideration.

Upper Palaeolithic

- 2.1.11 Upper Palaeolithic (35,000 to 12,000 BP) material is also known. Although nationally rare, evidence of the final Upper Palaeolithic "Long Blade" industry (dating to c. 12,000 BP) seems to be particularly prevalent in the Thames basin and in parts of East Anglia, and has regularly been noted in the Swanscombe and Ebbsfleet valley vicinity. Several distinctive Long Blade artefacts [two large blades and a core] were collected as surface finds from the general Swanscombe area by Henry Stopes in the late 19th century (Wenban-Smith 2004, Stopes Catalogue sites #5 The Mounts, #34 Botany Bay Pit, and #54 Hartley).
- 2.1.12 A prolific Long Blade scatter [from which nearly 240 artefacts survive, held by the British Museum, including 25 cores, 25 tools of various forms, and nearly 190 pieces of distinctive debitage] was recovered in the 1930s from a site ("Burchell's lower floor") near Springhead, towards the head of the Ebbsfleet Valley (Jacobi 1982).
- 2.1.13 Excavations undertaken in connection with HS1 in 2002 produced further evidence of Long Blade material at Springhead Nursery, c. 50m south of Burchell's site (Anderson-Whymark, Appendix I in Wenban-Smith *et al.* in press for 2017). A knapping scatter of more than 170 artefacts (including cores, large blades and one distinctive large "bruised blade") was recovered from a small area between Springhead Nursery and the entrance to the tunnel for HS1 under Pepper Hill, where colluvial slopewash deposits spread onto the side of the alluvial floodplain of the upper Ebbsfleet.
- 2.1.14 And finally, recent archaeological work at Redrow's Ebbsfleet Green housing development about 1km southwest of the DBA area has produced an undisturbed Long Blade knapping scatter with about 750 artefacts, including cores, large blades and various retouched tools (MOLA 2015).



2.2 History of Chalk extraction, development and statutory designation

- 2.2.1 The DBA area, and indeed the wider Ebbsfleet valley, have been subject to intensive "brickearth" [sandy clay-silt, suitable for brick-making] and chalk quarrying since the later 19th century. By 1895, several lower-lying areas of the western side of the valley had been cleared of the blanket of brickearth that originally covered it. After this time, quarrying became much more intensively focused upon the chalk that formed most of the valley and the surrounding south side of the Thames Estuary. The Ebbsfleet valley seems to have been located in a "sweet spot" from an industrial point of view, where extractable chalk without housing on it was close to the navigable Thames estuary. Therefore one of Britain's largest chalk extraction and cement-making centres formed at the head of the Ebbsfleet valley, and grew exponentially between c. 1895 and the 1970s; a particular boost to growth came in 1906, when the San Francisco earthquake led to strong American demand for cement and other building materials. The surrounding landscape became dominated by chalk pits, to the extent that almost every available part of the landscape that was not covered by main roads or housing ended up as a chalk pit, including the majority of the DBA area.
- 2.2.2 The most desirable land for chalk extraction was where chalk outcropped close below the ground surface. Such areas were rapidly exhausted, and then the economics of chalk extraction became a matter of balancing the cost and difficulty of clearing (and then disposing of) non-chalk overburden versus the profit to be made from the underlying chalk itself. Thus the history of quarry expansion in the Ebbsfleet valley reflected the evolution through the 20th century of increasingly efficient methods of clearing deeper overburden. Areas that had been left unquarried in the first half of the century began to be extracted in the second half, with the advent of larger and more effective machinery.
- 2.2.3 The relevance of this to Palaeolithic archaeology is that the "overburden" in the Ebbsfleet valley was formed of silts, sands and gravel that were a rich source of Palaeolithic remains. Amateur collectors in the late 19th century such as F Spurrell and H Stopes roamed the pits, collecting (and sometimes providing published reports on - Spurrell 1883) many wonderful artefacts and fossils, although most of the deposits from which they collected have long been lost to quarrying. The culture of amateur collecting continued through the 20th century, sometimes complemented by more professional investigations (described further below). By the 1960s, the unquarried deposits that survived were those where the underlying chalk was most inaccessible due to the great depth of overburden.
- 2.2.4 At this time, important archaeological remains began to be more widely protected by statutory designations such as listing as a "Scheduled Ancient Monument". This occurred for some unquarried parts within the Ebbsfleet valley, following from amateur investigations by JPT Burchell between c. 1930 and 1950 and subsequent follow-up investigations by the British Museum between c. 1965 and 1971. Two blocks of unquarried ground were scheduled for protection in the 1970s, designated as Area A and Area B (broadly corresponding with, respectively, areas PP 07 and PP 14 in **Figure 1**). These designations continue through to the present day, and have to a large extent secured the preservation of these sites while other deposits that once survived have almost entirely disappeared, apart from in a few isolated patches where some other means of coincidental protection occurred. For instance, of the other unquarried blocks of ground within the DBA area, one was protected by being under a conveyor belt (**Figure 1**, PP 13), one was under a 19th century footpath (**Figure 1**, PP 04), and another has a large electricity pylon on it (**Figure 1**, PP 08).



- 2.2.5 Up until the mid-1990s, the only developments in the valley were (a) industrial building complexes tied in with cement extraction, and (b) a sports ground for Blue Circle employees, which had a fine pavilion, a complex of football pitches, tennis courts and bowling greens, and a cricket pitch on which the Kent county team played regular matches between the 1950s and the 1970s. Then the decisions were taken in the early 1990s not only to route HS1 through the Ebbsfleet valley, but that there should also be an international station there. Thus a major development programme (with accompanying archaeological investigations, described below - **Section 2.3**) took place between c. 1997 and 2005. Besides construction of the track and the station, the surrounding area underwent major re-landscaping for car parks and access roads. This involved infilling and remediating all the old chalk pits, capping their infill with sterile deposits and grassing them over, and, after archaeological investigations where necessary, building up a substantial spread of made ground over much of the area, which was then concreted over to serve as car parks.
- 2.2.6 The landscape has changed so extensively as a result of this work that it is hard, without careful digital overlaying of historical mapping, to tie in the present day landscape with that before HS1. However the statutory designations of Areas A and B ensured that they were minimally affected by HS1 - with the notable exception of construction of the new electricity pylon ZR4 on Area A, more on which below (**Section 2.3**). The west face of Area A has had landfill banked against it, so it is becoming harder to see the site boundary on the ground. Area B in contrast has been preserved as an upstanding island of sediment, so is much easier to relocate on the ground.

2.3 Palaeolithic investigations in the DBA area

Overview

- 2.3.1 There has been a substantial history of investigation. Besides numerous instances of amateur collecting and minor investigations, the most significant investigations are listed below (**Table 2**). The Ebbsfleet valley deposits were first recognised as of Palaeolithic/Quaternary significance in the later 19th century (Spurrell 1883 & 1884). Field investigation has subsequently been carried out on numerous occasions, initially against a backdrop of increasing chalk extraction in the immediate surrounds through the late 19th century and the first half of the 20th century. Various research investigations were carried out between the 1960s and the 1990s, followed by a major phase of work in conjunction with the construction of High Speed 1 and the Ebbsfleet International station. Most recently, a walk-over survey and some targeted field investigations were carried out under Historic England's Heritage-at-Risk programme between 2012 and 2015.

<i>Date</i>	<i>Principal investigator/s</i>	<i>Key results</i>	<i>Surviving sediments</i>	<i>Reference/s</i>
1880s	FCJ Spurrell	First discovered Ebbsfleet Valley as containing richly fossiliferous Pleistocene deposits with Palaeolithic artefacts; identified Levalloisian "tortoise-core" technology - "Tramway Cutting" site	-	Spurrell 1883, 1884
1910	British Museum (RA Smith and H Dewey)	Larger and less-selective collection of Levalloisian artefacts from Coombe Rock in Southfleet Pit [aka "Baker's Hole"]	-	Smith 1911



1930s, 1950s	JPT Burchell	Discovered artefact-bearing and fossiliferous "Ebbsfleet Channel" deposits [Area B]; made large lithic and small faunal collections; identified interglacial "Temperate Bed" at Area B	PP14 [Area B]	Burchell 1933, 1935a,b, 1936, 1954 & 1957
1950s, 1960s	AT Marston and JN Carreck	Discovered new area of Pleistocene sediments rich in mammalian fossils and molluscs - "Northfleet Allotments" site [Area A]	PP 07 [Area A] PP 14 [Area F]	Carreck 1972
1969- 1971	British Museum (G Sieveking and MP Kerney)	Made records of key sediment sequences; carried out more detailed molluscan investigations at both of Area A ("Site A") and Area B	PP 07 [Area A] PP 14 [Area B]	Kerney & Sieveking 1977
1989- 1995	FF Wenban-Smith	PhD. More detailed primary records of surviving deposits; more intensive palaeo-environmental work on molluscs, small vertebrates and ostracods; chronometric dating with OSL and amino acid racemisation	PP 07 [Area A] PP 14 [Area B] PP 08 [Area C] PP 13 [Area D] PP 15 [Area E] PP 14 [Area F]	Wenban-Smith 1990, 1992, 1995 & 1996
1997- 2003	Oxford Wessex Archaeology	Pre-HS1. Numerous small-scale investigations of area affected by HS1 and Ebbsfleet International station; also major investigation in advance of new pylon ZR4 in Area A	PP 07 [Area A] PP 13 [Area D] PP 15 [Area E]	Oxford Archaeological Unit 2000; Wenban-Smith <i>et al.</i> in press for 2017
2012- 2015	FF Wenban-Smith	Heritage-at-Risk. Site-wide walkover survey and field investigations at Area B	PP 14 [Areas B, F]	Wenban-Smith 2012, 2015, 2016 & 2017

Table 2: Previous Palaeolithic work in the DBA area, main investigations.

RA Smith's "Baker's Hole" Levallois site

2.3.2 The Ebbsfleet valley was first recognised as of importance for its Levalloisian remains by Spurrell (1883, 1884) in the later 19th century, although the term "Levalloisian" was not yet in use at that time. He recovered very abundant flint artefacts with a distinctive "tortoise core" technology from chalk-rich slopewash deposits exposed in a pit rail cutting. This work seems to have been overlooked 20 years later, when in about 1910 the amateur collector J Cross drew the attention of the British Museum to "a strange series of stones" he had found in a newly-opened pit [called "Southfleet Pit"] not far from the location of Spurrell's cutting. Working with the support of the pit owners the Associated Portland Cement Manufacturers, a rich collection of Levalloisian artefacts (and also fossils such as horse, mammoth, rhinoceros and deer) was recovered from chalk-rich slopewash deposits in the northwest corner of the Southfleet Pit (Smith 1911). However, the name of this site, became (and remains) erroneously embedded in archaeological literature under the name "Baker's Hole" - which was in fact the name of an entirely different chalk pit a short distance to the west.



- 2.3.3 Historical map regression allows Spurrell's findspot to be located near NGR 561370 174045 at the east side of PP 15, and the location of the Cross/Smith "Baker's Hole" findspot to be located near NGR 561425 173875, just to the south of PP 13 (**Figure 1**).
- 2.3.4 Broadly similar deposits to those recorded at Smith's "Baker's Hole" Levallois site were recorded at PP 13 by Wenban-Smith (1995). Similar deposits were also present immediately to the east of PP13, and were investigated prior to their destruction by HS1 (Wenban-Smith *et al.* 2017). A few Levalloisian artefacts were found and optically stimulated luminescence (OSL) dating was carried out, which confirmed their age as most likely MIS 8-7, between c. 250,000 and 200,000 BP.

JPT Burchell's "Ebbsfleet Channel" sites [Area B]

- 2.3.5 JPT Burchell carried out very numerous and poorly reported investigations at the site in the early 1930s (Burchell 1933, 1935a, 1935b & 1936). He carried out small-scale excavations at numerous unrecorded locations in and around the surviving block of sediments that is now known as "Area B" and protected as a Scheduled Monument and Site of Special Scientific Interest (PP14d-f). He identified a suite of deposits banked up against Chalk bedrock, labelled by him as the "Ebbsfleet Channel" complex. Handaxes, Levallois cores and Levallois flakes were recovered from the gravel at the base of the sequence and these are presumed to be reworked from older deposits. Higher up the sequence (in a sequence of gravelly beds above his so-called "Lowermost Loam") he found horizons with undisturbed Levalloisian knapping scatters and the remains of a variety of larger mammals. Fish, small mammal and molluscan remains were also recovered in low quantities from various horizons. At the top of the sequence, within the higher western part of the island of deposits that is now protected as the "Area B" Scheduled Monument, he identified a "Temperate Bed" with abundant mollusc remains reflecting peak interglacial conditions, as well as containing occasional artefacts and larger mammalian remains.
- 2.3.6 Although our present-day understanding of this sequence has developed since Burchell's time, it was recognised as important at the time because of the strong evidence it provided of the long history of recurring interglacial and glacial periods between the era of the Boyn Hill terrace and the present day.
- 2.3.7 Although the precise locations of Burchell's excavations are unknown since he never made a map showing them, they were mostly in the close vicinity of the "Area B" Scheduled Monument (**Figure 1**, PP14; **Figure 5**, PP14d-f), and some them must have taken place within the surviving island of deposits.
- 2.3.8 Following from Burchell's work, the site was re-investigated by the British Museum in the period 1965-1971 (Kerney & Sieveking 1977). This work led to the site's protection as a Scheduled Monument, and better records were made of the sequence of deposits, and more detailed investigations were made of the molluscan evidence from the Temperate Bed.
- 2.3.9 Further work was carried out by F Wenban-Smith as doctoral research in the period 1993-1994 (Wenban-Smith 1995 & 1996), involving more detailed investigation of the Temperate Bed, and in particular recovery from it of small vertebrate remains and direct dating by optically stimulated luminescence (OSL). And finally the most recent period of investigation has been 2012-2015, when further field investigations of the surviving deposits in the protected area were carried out under Historic England's Heritage-at-Risk (HAR) programme. (Wenban-Smith 2012, 2015, 2016 & 2017).

2.3.10 This work has shown that the Ebbsfleet Channel sequence at Area B relates to the period MIS 8-7, between c. 250,000 and 200,000 BP, and that the Temperate Bed is rich in small vertebrate remains, including fish, amphibians, water shrew and northern vole *Microtus oeconomus*. However the most recent phase of HAR work has shown that the remains in the Temperate Bed seem to be deteriorating rapidly, and that the site is vulnerable to further deterioration that will diminish its value as a heritage resource. Approaches to future management of the site are therefore currently being considered..

Northfleet Allotments site [Area A]

2.3.11 The Northfleet Allotments site (**Figure 1**, PP07) - now protected as a Scheduled Monument and designated as a Site of Special Scientific Interest - was discovered by AT Marston in the 1950s. JN Carreck made a large collection of fossil bones from the site, which was exposed as a broadly horizontal sand/silt/gravel bed capping the east face of a large chalk pit (Ricksons Pit). This same face now forms the west side of the Scheduled Monument, although is now buried by made ground.

2.3.12 Carreck made an initial record of the stratigraphy, as well as identifying rich molluscan presence in at least one horizon and recovering a few lithic artefacts (Carreck 1972). The site was reinvestigated by the British Museum in 1965-1971 (**Figure 1**, site A; **Figure 8**) (Kerney & Sieveking 1977), and then by F Wenban-Smith in the period 1990-1994 (Wenban-Smith 1995 & 1996). This work, which includes OSL dating and amino acid dating, has shown that the sequence relates to the period MIS 8-7, between c. 250,000 and 200,000 BP, and contains at its base [bed 2 of Wenban-Smith's 1995 synthesis] evidence of an interglacial episode within MIS 7 that is different from, and earlier than, the interglacial episode represented in the Temperate Bed at Area B.

2.3.13 As part of the HS1 work, it was necessary to put the new electricity pylon "ZR4" within the Scheduled Monument of Area A. The site was evaluated in January 1998, and then excavated April-June 2000 (Oxford Archaeological Unit 2000; Wenban-Smith *et al.* in press for 2017), with separate investigations for the footings at each of the four corners of the pylon. It is instructive to note that very different remains were found in the two deeper uplift footings, which were only about 10m apart from each other. The most important remains were found in the southwest footing. The sequence contained fluvial sediments dating to late MIS 7, c. 200,000 BP, generally becoming finer-grained upwards from an active river gravel at the base, and then becoming more sandy/silty and clayey higher up in the sequence. Very abundant small vertebrate remains were recovered, with over 23,000 identified specimens. Larger vertebrate remains were relatively rare with specimens of mammoth/elephant, horse, bovid and red deer recovered. Molluscs and ostracods were also found.

2.3.14 The palaeo-environmental remains and amino acid dating indicate deposition in a peak interglacial episode late in MIS 7. Importantly, it can be shown on biostratigraphic grounds (the absence of bank vole) and by amino acid dating that this is a separate warm episode from the MIS 7 interglacial deposits at nearby Site A, c. 100m to the SSW (**Figures 1-2**). It is also distinct on slightly-less-robust biostratigraphic grounds (a statistically different clustering of northern vole tooth measurements) from the MIS 7 interglacial deposits of the Temperate Bed at Area B. The ZR4 site is therefore particularly important in complementing these two localities to provide a record within the Ebbsfleet Valley of all three of the warm interglacial episodes known to have occurred within MIS 7 between 240,000 and 190,000 BP.

2.3.15 Another piece of work for HS1 was carried out at the north-east corner of Area A, in the site labelled as "Area 8" where the sloping bank of HS1 was cut (**Figures 1-2**). Here a



record was made of the exposed deposits. The upper deposits were sands and silts that were dated to the general period MIS 6-2, between 190,000 BP and the start of the Holocene c. 12000 BP. Below this were silts and gravel deposits that were broadly equivalent with the basal parts of the ZR4 pylon sequence, although relatively lacking in palaeo-environmental remains.

- 2.3.16 One other relevant piece of work done under the HS1 programme was carried out a short distance to the east of Area A, in the footprint of the HS1 track. Here, in trench 3790 TT (**Figures 1-2**), a sequence of sands/silts was found that was dated to the Last Interglacial (MIS 5e) on the basis of the range of molluscan species contained at its base, and on amino acid dating.
- 2.3.17 The Area A Scheduled Monument is therefore particularly important in not only containing rich sequences of fossils dating to more than 200,000 years ago, but in containing distinct remains from different climatic episodes within MIS 7 and from other Middle-Late Pleistocene climatic sub-stages, including the Last Interglacial MIS 5e.

3 AREAS OF PALAEOLITHIC SIGNIFICANCE (PP AREAS)

- 3.1.1 The DBA area mostly consists of old chalk pits to the west of HS1 that have been backfilled and re-landscaped. There are however several areas of unquarried ground with higher Palaeolithic potential, including the Areas A and B (discussed above, **Section 2.3**) that are now protected as Scheduled Monuments and a Site of Special Scientific Interest. These have been designated as "PP areas", for "Paramount Palaeolithic". The locations of the various areas are shown (**Figure 1**), and closer views and subsidiary internal sub-divisions of Areas A and B are also given in separate figures (**Figure 2** and **Figure 5** respectively).
- 3.1.2 Descriptions of the known (or likely) Pleistocene deposits and Palaeolithic remains in each of these areas are given as an appendix (**Appendix 1**). For each area, its overall Palaeolithic potential is assessed, based on a matrix that combines the likelihood of any Palaeolithic remains and their likely importance. Criteria for these assessments are given at the front of the appendix.

4 IMPACT ASSESSMENT OF PROPOSED ROUTE OPTIONS

4.1 General considerations

- 4.1.1 Four different route options are considered in this report, based on information received from the client and supplied by Wessex Archaeology:
- the footprint of the main access road (eastern route) route shown as "tunnel/bridge" in yellow on the issued scoping plans (**Figures 1, 4, 5**)
 - the footprint of Option 1 for a combined cycle/tram people-mover route shown in blue and light green on the issued scoping plans (**Figures 1, 4, 5**)
 - the footprint of Option 2 of a combined cycle/tram people-mover route shown in brown on the issued scoping plans (**Figure 6**)
 - the footprint of Option 3 of a combined cycle/tram people-mover route shown in purple, arising from the meeting with curatorial authorities and LRH held at Savills, 33 Margaret Street, London on 24th (**Figure 7**)



- 4.1.2 For each of these route options, the path of the route through the DBA area was divided into zones of deposit character and Palaeolithic potential (**Sections 4.2-4.4**); these are discussed in the subsequent section (**Section 5**).
- 4.1.3 No information has been supplied on design specifications for any of the route options, which would give an indication of their depth of impact on underlying sediments. However, it should be noted that, in the meeting held at Wessex Archaeology in October 2016 and in the briefing information received from Historic England on behalf of the combined curatorial authorities [email from Peter Kendall, sent 15th June 2017, 16:17], "impact" is construed as including "lack of future access". This therefore includes deposits under the footprint of any particular route, regardless of the actual depth of cut impact, as well as deposits rendered inaccessible by proximity to a route.
- 4.1.4 This report therefore focuses upon the footprints of the route options supplied, without any consideration of the actual depth of cut impact; this latter information has not in any case been supplied.

4.2 Bridge/tunnel and Option 1 cycle/tram route

- 4.2.1 The route options for the main access road (eastern route) and the Option 1 cycle tram route are shown in relation to the overall DBA area and the recognised areas of higher Palaeolithic potential (**Figure 1**). A closer view is shown for the path of these routes across area PP 07, which equates with the Scheduled Monument of Area A (**Figure 2**).
- 4.2.2 The routes have been subdivided into zones 1.1 through to 1.7, based on changing character and Palaeolithic potential of the underlying deposits. Details of the character and potential of each zone are given as a separate appendix (**Appendix 2**). Where these zones correspond with PP areas, the information is similar (often identical) to that given for the PP areas in Appendix 1. However, some consideration is given as to which part of a PP area is affected - for instance the main access road passes along the east side of PP 07, whereas the cycle/tram route passes up the middle of the area, to the west of the ZR4 pylon. New information is provided for zones along the routes that do not correspond with PP areas. These zones are usually lacking in Palaeolithic potential, but in some instances there is a low or moderate Palaeolithic potential based on the possibility of there being deeply buried remnants of deposits.
- 4.2.3 Bearing in mind the complexity and high importance of zone 1.7, where these routes cross the Area A Scheduled Monument [=PP 07], stratigraphic transects are illustrated, showing a cross-section of the deposits in this area based on previous investigations (**Figures 3 and 4**). The recorded sequence of deposits along the west side is also shown (**Figure 8**). An attempt has been made to model the underlying deposits in more detail, and the zone has been sub-divided into five subsidiary areas PP07a-e (**Figures 2, 7; Table 3**). It should be emphasised that this is a speculative model, and there is little information on which to base it, other than the known records from the west face of PP07 (**Figure 8**), and the field investigations at Site A, ZR4, Area 8 and 3790 TT..

<i>Sub-area</i>	<i>Description and interpretation of sub-zone</i>	<i>Notes, comments</i>
PP 07a	Channel bank	This deposits are probably not important in themselves, although this area preserves an important record of the location of the MIS 7 channel bank
PP 07b	Early MIS 7 deposits (MIS 7e)	This area probably is dominated by early MIS 7 deposits similar to those investigated at Site A, underlying a thick mantle of later



		slopewash deposits
PP 07c	Transitional zone between Site A (early MIS 7) and ZR4 (later MIS 7) deposits	This area must preserve the critical record of the transition between the sequences at Site A and ZR4. Bearing in mind the proven capacity of Pleistocene deposits to vary and appear/disappear over short distances, the only way this transition can be meaningfully investigated is to dig and record a continuous section between Site A and ZR4.
PP 07d	Late MIS 7 deposits (MIS 7c-a)	This area probably is dominated by later MIS 7 deposits similar to those investigated at ZR4, underlying a thick mantle of later slopewash deposits
PP 07e	Transitional zone between ZR4 (later MIS 7) and 3790 TT (MIS 5e) deposits	This area must preserve the critical record of the transition between the sequences at ZR4 and 3790 TT. Bearing in mind the proven capacity of Pleistocene deposits to vary and appear/disappear over short distances, the only way this transition can be meaningfully investigated is to dig and record a continuous section from ZR4 towards the bank of the HS1 cutting. This was proposed as part of the HS1 mitigation programme [the "Northern Dog-leg"] but was not supported by Rail Link Engineering (N), who were delivering the HS1 archaeological programme in the Ebbsfleet Valley.

Table 3: Subsidiary areas within Palaeolithic area PP 07.

4.3 Option 2 cycle/tram route

- 4.3.1 A separate figure shows the Option 2 cycle tram route in relation to the overall DBA area and the recognised areas of higher Palaeolithic potential (**Figure 6**).
- 4.3.2 The route has been subdivided into zones 2.1 through to 2.8, based on changing character and Palaeolithic potential of the underlying deposits. Details of the character and potential of each zone are given as a separate appendix (**Appendix 3**). Where these zones correspond with PP areas, the information is similar (often identical) to that given for the PP areas in Appendix 1. However, some consideration is given as to which part of a PP area is affected - for instance the route passes through the lower east end of PP 04, which has much lower potential than its west end. New information is provided for zones along the routes that do not correspond with PP areas. These zones are usually lacking in Palaeolithic potential, but in some instances there is a low or moderate Palaeolithic potential based on the possibility of there being deeply buried remnants of deposits.

4.4 Option 3 cycle/tram route

- 4.4.1 A separate figure shows the Option 3 cycle tram route in relation to the overall DBA area and the recognised areas of higher Palaeolithic potential (**Figure 7**).
- 4.4.2 The route has been subdivided into zones 3.1 through to 3.9, based on changing character and Palaeolithic potential of the underlying deposits. Details of the character and potential of each zone are given as a separate appendix (**Appendix 4**). Where these zones correspond with PP areas, the information is similar (often identical) to that given for the PP areas in Appendix 1. However, some consideration is given as to which part of a PP area is affected - for instance the route passes through the west side of PP 07, which has much more known about it than the central part. New information is provided for zones along the routes that do not correspond with PP areas. These zones are usually lacking in Palaeolithic potential, but in some instances there is a low or



moderate Palaeolithic potential based on the possibility of there being deeply buried remnants of deposits..

5 DISCUSSION

5.1 Main access road (eastern route) and Option 1 cycle/tram route

5.1.1 The Palaeolithic potential of different zones along these routes is summarised in the table below (**Table 4**), which condenses and extracts the information in Appendix 2. The one main difference is that this table focuses upon more-likely Palaeolithic remains, rather than just-possible ones. For zone 1.5, there is a row marked with an asterisk that specifically relates to the possibility of there being remnants of Holocene alluvium, which might seal some Late Upper Palaeolithic Long Blade remains. Similar landscape situations have produced Long Blade remains about 1km up the Ebbsfleet, towards Springhead.

Zone	Route	PP area	Overall Pal potential	Likely Palaeolithic remains	Evaluation priorities	Possible approaches to evaluation
1.1	Rd-E & CT-1	PP 13	MODERATE	Levalloisian flints and mammalian fossils	- presence/depth of natural deposits - nature/potential of Pal remains	Test pits, boreholes
1.2	Rd-E & CT-1	-	VERY LOW	None	-	-
1.3	Rd-E	PP 15	HIGH	Levalloisian flints, mammalian fossils and other palaeo-environmental remains	- presence/depth of natural deposits - nature/potential of Pal remains	Test pits
	CT-1	PP 15a	HIGH	Levalloisian flints, mammalian fossils and other palaeo-environmental remains	- presence/depth of natural deposits - nature/potential of Pal remains	Test pits
1.4	Rd-E & CT-1	-	LOW	Levalloisian flints, mammalian fossils (deeply buried)	- presence/depth of natural deposits - nature/potential of Pal remains	Test pits, boreholes
1.5	Rd-E & CT-1	-	VERY LOW	None (Lower/Middle Pal)	-	-
		-	MODERATE *	Long Blade industry (Upper Pal)	- presence/depth of Holocene alluvium - nature/potential of Pal remains	Test pits, boreholes



1.6	Rd-E	PP 07	VERY HIGH	MIS 7 and MIS 5e deposits, under MIS 5d-2 slopewash	- presence/depth of natural deposits - nature/potential of Pal remains (esp. palaeo-environmental)	Test pits, boreholes
	CT-1	PP 07	VERY HIGH	MIS 7 deposits, under MIS 5d-2 slopewash	- presence/depth of natural deposits - nature/potential of Pal remains (esp. palaeo-environmental)	Test pits, boreholes
1.7	Rd-E & CT-1	-	VERY LOW	None	-	-

Table 4: Overview of Palaeolithic potential, evaluation priorities and suggested evaluation methods for zones along main eastern access road [Rd-E] and cycle/tram Option 1 route [CT-1][* zone 1.5, assessment for Late Upper Palaeolithic remains]

Bridge/tunnel route

5.1.2 This route is presumably a major road, although no information has been received as to whether it is a bridge or tunnel and what impact this might have on underlying deposits, and, regardless of the direct impact, whether they will remain accessible. Different zones along the route are discussed in turn below.

Zone 1.1 [= PP 13].

5.1.3 This doesn't seem problematic. There is MODERATE potential here to recover artefactual and fossil mammalian remains from chalk-rich slopewash deposits that may be equivalent to those from RA Smith's original "Baker's Hole" Levalloisian site. It will be easy enough to establish if any such remains are present by field evaluation, and if so to carry out appropriate mitigation. The impact will only affect part of the zone, so adjacent equivalent deposits will continue to survive. From a heritage point of view, there would be a gain in understanding by investigation of any such sediments that would offset their loss.

Zone 1.2.

5.1.4 There is VERY LOW Palaeolithic potential in this zone. Scarce surviving channel-bases were mapped and walked-over during the HS1 work, and it was not thought then that they merited any targeted investigation. Natural Pleistocene deposits are now so deeply buried that any meaningful investigation is entirely impractical, even if deemed desirable, whether or not any development takes place on the ground surface.

Zone 1.3 [= PP 15].

5.1.5 There is HIGH Palaeolithic potential in this zone. It is uncertain what natural deposits might survive, and at what depth since there are no records of any investigations having taken place. However this area is very close to Spurrell's original pit cutting discoveries. It should be easy to investigate by means of test pits what (if any) natural deposits survive, and then to carry out suitable mitigation. Bearing in mind that we currently know



nothing about sediments in this area, there would be a gain in understanding by investigation that would offset their loss.

Zone 1.4.

- 5.1.6 There is LOW Palaeolithic potential in this zone. This area is probably the most difficult for which to give a confident interpretation of its potential. It is uncertain how deeply the quarrying for brickearth went in the late 19th century, nor what Pleistocene deposits (if any) were left unquarried. It is then uncertain how deeply it was backfilled, if at all, and it is also uncertain to what extent construction and levelling of the sports pitches might have affected any underlying sediments. There are no records of any investigations in this area. Some test pits and geotechnical investigations on its eastern periphery suggest the area was deeply covered by made ground, even before further ground make up to form the car park that now covers this area. Therefore, similarly to zone 1.2, any natural Pleistocene deposits (even if containing important remains) are now so deeply buried that any meaningful investigation is entirely impractical, whether or not any further development takes place on the ground surface.

Zone 1.5.

- 5.1.7 There is VERY LOW Lower/Middle Palaeolithic potential in this zone. However, there is MODERATE Late Upper Palaeolithic potential, bearing in mind the proximity of the alluvial Ebbsfleet floodplain, there is a possibility that Holocene alluvium might be present, and if so that this might seal important Late Upper Palaeolithic Long Blade remains. Similar landscape situations have produced Long Blade remains about 1km up the Ebbsfleet, towards Springhead.

Zone 1.6 [= PP 07, east side].

- 5.1.8 There is VERY HIGH Palaeolithic potential in this zone. The tunnel/bridge route passes along the east side of area PP 07, parallel with the HS1 track. The route transects sub-zones PP 07c through to PP 07e (see **Table 3**), and it passes directly between the ZR4 pylon (where later MIS 7 interglacial sediments are present) and the location of 3790 TT (where Last Interglacial MIS 5e interglacial sediments are present). The route thus transects the intermediate zone between these two localities. If the relationship between these two sets of deposits is to be properly understood by direct recording of the lithostratigraphy, palaeo-environmental sampling (small vertebrate, molluscan, ostracods) and further dating work (amino acid dating and OSL), then this work would have to be done prior to construction of the route, because once built it would hinder access to this transitional zone.

Zone 1.7.

- 5.1.9 There is VERY LOW Palaeolithic potential in this zone. This zone comprises the natural ground preserved beneath the footpath, but there is only likely to be a very thin veneer of slopewash deposits overlying chalk bedrock, and any Palaeolithic remains will be reworked and of low importance.

Cycle/tram route, Option 1

- 5.1.10 No information has been received on the impact this might have on underlying deposits, and, regardless of the direct impact, whether they will remain accessible. Different zones along the route are discussed in turn below. The zones along this route have similar considerations to the tunnel/bridge route, apart from certain stretches as outlined below.

Zone 1.1 [= PP 13].

- 5.1.11 Same as for the bridge/tunnel route.



Zone 1.2.

5.1.12 Same as for the bridge/tunnel route.

Zone 1.3 [= PP 15a].

5.1.13 There is HIGH Palaeolithic potential in this zone. It is uncertain what natural deposits might survive, and at what depth since there are no records of any investigations having taken place. However this area is close to Spurrell's original pit cutting discoveries, as well as close to localities where important remains have been found (area PP 14), and unrecorded localities where Burchell found undisturbed Levalloisian knapping floors. This area is preserved under an old paved track within the Blue Circle quarry complex that dates back to c. the 1970s and which sealed various MIS 7 deposits further east (investigated during the HS1 archaeological programme in the Jayflex remediation area). It has not been backfilled by HS1 construction work, meaning that any natural sediments will be less deeply buried than in area PP 15. This area is perhaps the best opportunity we have of rediscovery, and carrying out proper investigation of, undisturbed Levalloisian knapping floors from MIS 7. It should be easy to investigate by means of test pits what (if any) natural deposits survive, and then to carry out suitable mitigation. Bearing in mind that we currently know nothing about sediments in this area, there would be a gain in understanding by investigation that would offset their loss.

Zone 1.4.

5.1.14 Same as for the bridge/tunnel route.

Zone 1.5.

5.1.15 Same as for the bridge/tunnel route.

Zone 1.6 [= PP 07, centre].

5.1.16 There is VERY HIGH Palaeolithic potential in this zone. The tunnel/bridge route passes up the middle of area PP 07, between Site A (where early MIS 7 interglacial sediments are present) and the ZR4 pylon (where later MIS 7 interglacial sediments are present). The route mostly intersects with sub-zones PP 07b and PP 07c (see **Table 3**). The route thus transects the transitional zone between these two localities. If the relationship between these two sets of deposits is to be properly understood by direct recording of the lithostratigraphy, palaeo-environmental sampling (small vertebrate, molluscan, ostracods) and further dating work (amino acid dating and OSL), then this work would have to be done prior to construction of the route, because once built it would hinder access to this transitional zone, and hinder the future possibility of any investigation of the direct lithostratigraphic relationship between the deposits at Site A and those at ZR4.

Zone 1.7.

5.1.17 Same as for the bridge/tunnel route.

5.2 Option 2 cycle/tram route

5.2.1 The Palaeolithic potential of different zones along this route is summarised in the table below (**Table 5**), which condenses and extracts the information in Appendix 3. The one main difference is that this table focuses upon more-likely Palaeolithic remains, rather than just-possible ones.

<i>Zone Route</i>	<i>Overall Pal PP area potential</i>	<i>Likely/possible Palaeolithic remains</i>	<i>Evaluation priorities</i>	<i>Possible approaches to evaluation</i>
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2.1	CT-2	PP 13	MODERATE	Levalloisian flints and mammalian fossils	- presence/depth of natural deposits - nature/potential of Pal remains	Test pits, boreholes
2.2	CT-2	-	VERY LOW	None	-	-
2.3	CT-2	PP 15a	HIGH	Levalloisian flints, mammalian fossils and other palaeo-environmental remains	- presence/depth of natural deposits - nature/potential of Pal remains	Test pits
2.4	CT-2	-	LOW	Levalloisian flints, mammalian fossils (deeply buried)	- presence/depth of natural deposits - nature/potential of Pal remains	Test pits, boreholes
2.5	CT-2	-	VERY LOW	None	-	-
2.6	CT-2	-	NONE	None	-	-
2.7	CT-2	PP 04	MODERATE	Lower Palaeolithic flints (reworked)	- presence/depth of natural deposits - nature/potential of Pal remains	Test pits
2.8	CT-2	-	NONE	None	-	-

Table 5: Overview of Palaeolithic potential, evaluation priorities and suggested evaluation methods for zones along cycle/tram route Option 2 [CT-2].

5.2.2 No information has been received on the impact construction methods for Option 2 might have on underlying deposits, and, regardless of the direct impact, whether they will remain accessible. Different zones along the route are discussed in turn below. The zones along this route have similar considerations to the Option 1 route in its more southerly half (zones 2.1 to 2.4), then there are different considerations for its northern half (zones 2.5 to 2.8), as outlined below.

Zone 2.1 [= PP 13].

5.2.3 Same as for the Option 1 cycle/tram route (Zone 1.1).

Zone 2.2.

5.2.4 Same as for the Option 1 cycle/tram route (Zone 1.2).

Zone 2.3 [= PP 15a].

5.2.5 Same as for the Option 1 cycle/tram route (Zone 1.3).

Zone 2.4.

5.2.6 Same as for the Option 1 cycle/tram route (Zone 1.4).

Zone 2.5.

5.2.7 There is VERY LOW Palaeolithic potential in this zone. If any Pleistocene deposits survive, they would be a continuation of the thick MIS 5d-2 dry valley fill sequence that is represented in area PP 08.



Zone 2.6.

5.2.8 There is NONE Palaeolithic potential in this zone. This stretch of the Option 2 cycle/tram route is entirely within a former chalk pit, now infilled and grassed over.

Zone 2.7 [= PP 04, east end].

5.2.9 There is MODERATE Palaeolithic potential in this zone. This zone passes through the eastern (and lower potential) end of area PP 04. It is likely that reworked Palaeolithic artefacts would be found in superficial slopewash deposits, but these would have very little potential to contribute to any current or future research priorities.

Zone 2.8.

5.2.10 There is NONE Palaeolithic potential in this zone. This stretch of the Option 2 cycle/tram route is entirely within a former chalk pit, now partly infilled.

5.3 Option 3 cycle/tram route

5.3.1 The Palaeolithic potential of different zones along this route is summarised in the table below (**Table 6**), which condenses and extracts the information in Appendix 4. The one main difference is that this table focuses upon more-likely Palaeolithic remains, rather than just-possible ones.

<i>Zone</i>	<i>Route</i>	<i>PP area</i>	<i>Overall Pal potential</i>	<i>Likely/possible Palaeolithic remains</i>	<i>Evaluation priorities</i>	<i>Possible approaches to evaluation</i>
3.1	CT-3	PP 13	MODERATE	Levalloisian flints and mammalian fossils	- presence/depth of natural deposits - nature/potential of Pal remains	Test pits, boreholes
3.2	CT-3	-	VERY LOW	None	-	-
3.3	CT-3	PP 15a	HIGH	Levalloisian flints, mammalian fossils and other palaeo-environmental remains	- presence/depth of natural deposits - nature/potential of Pal remains	Test pits
3.4	CT-3	-	LOW	Levalloisian flints, mammalian fossils (deeply buried)	- presence/depth of natural deposits - nature/potential of Pal remains	Test pits, boreholes
3.5	CT-3	-	VERY LOW	None	-	-
3.6	CT-3	PP 07	VERY HIGH	MIS 7 deposits, under MIS 5d-2 slopewash	- depth/character of MIS 7 deposits - nature/potential of Pal remains (esp. palaeo-environmental)	Test pits
3.7	CT-3	PP 07	VERY HIGH	MIS 7 deposits, under MIS 5d-2 slopewash	- depth of MIS 7 deposits - nature/potential of Pal remains (esp. palaeo-environmental)	Test pits



3.8	CT-3	-	VERY LOW	Reworked artefacts from Boyn Hill terrace	Confirm absence of MIS 7 channel edge	Test pits
3.9	CT-3	-	NONE	None	-	-

Table 6: Overview of Palaeolithic potential, evaluation priorities and suggested evaluation methods for zones along cycle/tram option 3 route [CT-3]

5.3.2 No information has been received on the impact construction methods for Option 2 might have on underlying deposits, and, regardless of the direct impact, whether they will remain accessible. Different zones along the route are discussed in turn below. The zones along this route have similar considerations to the Option 1 route in its more southerly half (zones 2.1 to 2.4), then there are different considerations for its northern half (zones 2.5 to 2.8), as outlined below.

Zone 3.1 [=PP 13].

5.3.3 Same as for the cycle/tram route Options 1 and 2, (Zones 1.1 and 2.1).

Zone 3.2.

5.3.4 Same as for the cycle/tram route Options 1 and 2, (Zones 1.2 and 2.2).

Zone 3.3 [=PP 15a].

5.3.5 Same as for the cycle/tram route Options 1 and 2, (Zones 1.3 and 2.3).

Zone 3.4.

5.3.6 Same as for the cycle/tram route Options 1 and 2 (Zones 1.4 and 2.4).

Zone 3.5

5.3.7 Same as for the cycle/tram route Options 1 and 2, (Zones 1.5 and 2.5).

Zone 3.6

5.3.8 There is VERY HIGH potential in this area. As can be seen from the recorded section (**Figure 8**), the deposits here are divided from those of zone 3.7 by a stratigraphic discontinuity. The deposits in this zone have never been studied, and it isn't known what evidence they contain or how they relate to the better-investigated deposits of zone 3.7. Addressing this gap in understanding is a key research priority for the site.

Zone 3.7

5.3.9 There is VERY HIGH potential in this area. As can be seen from the recorded section (**Figure 8**), the deposits here are divided from those of zone 3.6 by a stratigraphic discontinuity. The deposits in this zone were investigated by the British Museum in 1965-1970 (BM Site A excavation) and then further investigation of Site A (by F Wenban-Smith) took place in the early 1990s. However this previous work is limited in scale and scope. The full potential of the deposits for improving our understanding of the site has yet to be achieved. Enough work has been done, however, to suggest that the basal part of the sequence (**Figure 8** - deposits 3 and 4) relates to the earliest substage "e" of the MIS 7 interglacial. It isn't known how these MIS 7e deposits relate to the un-investigated deposits of zone 3.6. Addressing this gap in understanding is a key research priority for the site.



Zone 3.8

- 5.3.10 There is VERY LOW Palaeolithic potential in this zone. This zone passes beyond the bank of the MIS 7 channel, and then east of the east end of area PP 04. It is possible that reworked Palaeolithic artefacts would be found in superficial slopewash deposits, but these would have very little potential to contribute to any current or future research priorities.

Zone 3.9

- 5.3.11 There is NONE Palaeolithic potential in this zone. This stretch of the Option 3 cycle/tram route is entirely within a former chalk pit, now partly infilled [equivalent to Option 2, zone 2.8].

6 CONCLUSIONS

- 6.1.1 All of these route options have impacts upon areas of high Palaeolithic potential. No alternative options were presented for the main access road route, which passes through areas of MODERATE , HIGH and VERY HIGH potential (areas PP 13, PP15 and PP 07 respectively). It would be necessary to carry out field evaluation of the parts of the route that pass through these areas to clarify their potential, and to establish suitable methods of further investigation that could provide adequate mitigation of any proposed development impact.
- 6.1.2 For the three options presented for the cycle/tram route, it is clear that Option 2 has a significantly lesser impact upon Palaeolithic remains. However, if this option is impossible, then Option 3 seems more viable than Option 1 from a heritage impact perspective.
- 6.1.3 All of Options 1, 2 and 3 pass through areas of MODERATE and HIGH potential (areas PP 13 and PP15a respectively) in their shared southern half. Beyond that Option 2 passes through areas of LOW or NONE potential, apart from through a short stretch of the eastern end of PP 04 which has been characterised as of MODERATE potential.
- 6.1.4 In contrast, the northern half of Option 1 passes north-south through the entire length of the VERY HIGH potential area PP 07. Furthermore, it cuts between Site A and ZR4, and thus would compromise the future possibility of any investigation of the direct lithostratigraphic relationship between the deposits at Site A and those at ZR4, and carrying out further palaeo-environmental sampling (small vertebrate, molluscan, ostracods) and dating work (amino acid dating and OSL) of directly-relatable deposits that would help understand the relationship between these deposits better. The particular difficulty with this option is that the deposits in the central part of Area A have never been investigated. It is not possible without major prior field evaluation to establish where exactly the most significant deposits are located, and it is also possible that there might be something unforeseen of high importance.
- 6.1.5 If Option 2 is unachievable, Option 3 is preferable to Option 1. Although it likewise passes north-south through the VERY HIGH potential area PP 07, it passes down the west side of this area (zones 3.6 and 3.7), avoiding the transitional zone between Site A and ZR4. The deposits along the west side have only been minimally investigated to date, but they have been broadly surveyed and their character and depth are known (**Figure 8**). The research priorities for their investigation are well-established (**Appendix 4**, zones 3.6 and 3.7), as are the methods that should be applied: in particular palaeo-environmental sampling, small vertebrate and molluscan analysis, and amino acid



dating. Therefore it is possible with a high degree of confidence to develop a moderate-scale programme of targeted fieldwork that would (subject to approval by the relevant curatorial authorities) provide adequate mitigation for any impact of this route option.



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8 APPENDICES

8.1 Appendix 1: Defined areas of higher Palaeolithic potential (PP nn) in the DBA area.



Contents

<i>Page</i>	<i>Details</i>	<i>Notes, comments</i>
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2	Table structure, and entry explanations	Tabular overview
3	Attribute grades for <i>Likelihood</i> and <i>Importance</i> of Palaeolithic remains	Tabular overview
4	Attribute grades for <i>Palaeolithic potential</i>	Tabular overview
5-13	Attribute tables for PP areas	Separate table for each PP area (and subsidiary area) relevant to this DBA: PP04, PP07, PP08, PP13, PP14a-b, PP14c, PP14d-f, PP15 and PP15a



Attribute table structure, and field entry explanations

<i>Attribute</i>	<i>Field entry</i>
PP #	Defined area of Palaeolithic potential - PP nn
Summary description	Short summary text of geomorphological and topographic situation
Sediment sequence	Description of the Quaternary deposits that may be, or are likely to be, present
Sediment depth	Likely elevation OD of natural sediments, and depth of burial, if known
Palaeolithic artefacts	Description of Palaeolithic artefactual remains that may be, or are likely to be, present
Palaeo-environmental remains	Description of faunal (and other palaeo-environmental) remains that may be, or are likely to be, present
Age/correlation	Presumed/possible age of deposits, and regional correlations to significant deposits, if known
Palaeolithic potential	Attribution based on matrix of likelihood and importance, and supported by brief explanatory text *
Likelihood of Palaeolithic remains	Attribution based on likely type/s of deposit present and previous artefact and palaeo-environmental find records, supported by brief explanatory text *
Likely importance of Palaeolithic remains	Attribution based on likely type/s of deposit present, and supported by brief explanatory text *
Priorities for evaluation	Key questions that need answering, to allow fully-informed consideration of the Palaeolithic potential/importance of the area
Approaches to evaluation	Suitable methods and approaches that could be applied to address the priority evaluation questions specified above
Any other comments	Any particular points not covered by other fields

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Attribute grades for Likelihood and Importance of Palaeolithic remains

<i>Attribution</i>	<i>Likelihood</i>	<i>Importance</i>
VERY HIGH	Certain knowledge of Pleistocene deposits with lithic or palaeo-environmental remains	Nationally important remains: undisturbed occupation surfaces or minimally disturbed artefact concentrations; abundant faunal /palaeo-environmental remains, deposits with key sequences and lithostratigraphic relationships
HIGH	High likelihood of Pleistocene deposits with lithic or palaeo-environmental remains	Undisturbed occupation surfaces or minimally disturbed concentrations; abundant remains from deposits of good stratigraphic and chronological integrity, biological associations; deposits with important lithostratigraphic sequences and relationships
MODERATE	Reasonable likelihood of deposits with remains	Less abundant disturbed artefactual and/or faunal remains from units of reasonable stratigraphic and chronological integrity; deposits with moderate lithostratigraphic sequences and relationship
LOW	Remains are known to occur, but rare	Disturbed remains from deposits of low stratigraphic and chronological integrity; deposits with minimal lithostratigraphic sequences and relationships
VERY LOW	Remains very unlikely to occur	Thought extremely unlikely for there to be any Pleistocene deposits containing remains, any remains found will be residual and reworked
NONE	No possibility of remains	Not applicable
UNCERTAIN	Insufficient information on which to assess likelihood	Insufficient information on which to assess importance



Matrix for assessment of Palaeolithic potential

<i>Palaeolithic potential</i>	<i>Likelihood</i>	<i>Likely importance</i>
VERY HIGH	Very high	High
	High	Very high
HIGH	High	High, Moderate
	Moderate	High
MODERATE	High	Low
	Moderate	Moderate
	Low	Very high, High
LOW	Moderate	Low
	Low	Moderate
	Very low	Very high, High, Moderate,
VERY LOW	Moderate	Very low
	Low, Very low	Low, Very low
NONE	None	na
UNCERTAIN	Uncertain	High, moderate, low or very low
	High, moderate, low or very low	Uncertain



PP #	PP 04
Summary description	Strip of unquarried deposits under footpath that runs east from Swanscombe to Northfleet over HS1, dipping eastward from Boyn Hill terrace down to Ebbsfleet Holocene alluvium
Sediment sequence	Boyn Hill deposits — Lower Gravel (fluvial gravel), Lower Loam (fluvial sand/silt with palaeo-landsurface), Lower Middle Gravel (fluvial gravel), Upper Middle Gravel (fluvial gravel-rich sand) — overlain by slopewash/solifluction deposits. Boyn Hill deposits thin and disappear at east end of zone, truncated by slope of ground surface.
Sediment depth	Boyn Hill deposits between 30 and 23 m OD at the west end of the footpath, and then ground surface steadily dipping down eastward to c. 15m OD at east end of area
Palaeolithic artefacts	Clactonian artefacts (flakes, cores and flake-tools) in Lower Gravel and Lower Loam, associated with undisturbed horizons in Lower Loam; Acheulian artefacts (handaxes, flakes and occ. flake-tools) in Lower Middle Gravel, also associated with undisturbed palaeo-landsurfaces; possibly scarce remains in UMG
Palaeo-environmental remains	Large mammalian faunal remains in Lower Gravel, Lower Loam, Lower Middle Gravel; poss. scarce remains in UMG; molluscan and small vertebrate remains present in LG and LL, possibly also in LMG and UMG in undecalcified patches
Age/correlation	MIS 11 (Hoxnian) Boyn Hill deposits, overlain by younger (MIS 10, or even younger) solifluction/slopewash deposits
Palaeolithic potential	VERY HIGH
Likelihood of Palaeolithic remains	Very high
Likely importance of Palaeolithic remains	High
Priorities for evaluation	Establish where natural deposits survive, their geological age/nature and their Palaeolithic potential
Approaches to evaluation	Test pits and boreholes either side of footpath; clean N-facing and S-facing sections below footpath
Any other comments	The west end of this area may preserve an important record of the full Boyn Hill terrace sequence

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



PP #	PP 07
Summary description	Unquarried ground [old Northfleet allotments] to west of HS1 and south of Swanscombe-Northfleet footpath; includes part of the Baker's Hole Scheduled Monument and SSSI complex.
Sediment sequence	<ul style="list-style-type: none"> • Fluvial/alluvial silts, sands & gravels (probably several phases of terrace deposition) • Marsh deposits (clayey sands and silts) • Colluvial/aeolian deposits (sands/silts)
Sediment depth	Base of Pleistocene sequence dips down to east from c. 9m to below 0m OD. Key horizons mostly buried by at least 2m of unimportant colluvial sand/silt - except at east side of area, where truncated by sloping west side of HS1 cutting
Palaeolithic artefacts	Few artefacts known, but records of a handaxe and flake from fine-grained loam towards the base of the sequence
Palaeo-environmental remains	Very abundant and well-preserved vertebrate, molluscan and ostracod remains
Age/correlation	MIS 7 interglacial deposits, overlain/abuted by younger (MIS 6 - MIS 2) slopewash deposits, and possibly Last Interglacial (MIS 5e) fluvial/alluvial deposits in eastern side of area
Palaeolithic potential	VERY HIGH
Likelihood of Palaeolithic remains	Very high
Likely importance of Palaeolithic remains	Very high
Priorities for evaluation	Establish how Site A and ZR4 sequences relate, what lithostratigraphic variations there are within the zone, and overall Palaeolithic/Pleistocene importance of different deposits present
Approaches to evaluation	Boreholes and test-pits, with a significant degree of palaeo-environmental assessment; geo-physics
Any other comments	This zone is part of the Baker's Hole Scheduled Monument and Site of Special Scientific Interest. It contains palaeo-environmental evidence of different sub-stages of MIS 7, as well MIS 5e and other subsequent periods, which makes it of national importance.

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



PP #	PP 08
Summary description	Island of predominantly-natural sediments with a pylon, surrounded by made-up ground (landfill) filling old Chalk quarries. In centre of what used to be a dry valley dipping ENE from Swanscombe down to the Ebbsfleet alluvial floodplain
Sediment sequence	Thick body of colluvial/aeolian sand/silt over Chalk bedrock, filling a dry valley that comes down into the Ebbsfleet valley from higher ground to the west; includes minor channel of fluvial/slopewash gravels at east side
Sediment depth	Top surface of sequence slopes gently NE from c. 15 m to 13 m OD; there is a thick covering of made ground down to Chalk at the western side; the central and eastern parts are covered with between 3 and 5 m of colluvial sand/silt deposits, with a minor stream channel infilled with gravel outcropping at the eastern side
Palaeolithic artefacts	None known
Palaeo-environmental remains	None known
Age/correlation	Probably mostly MIS 5d - MIS2
Palaeolithic potential	VERY LOW - Lower/Middle Palaeolithic MODERATE - Upper Palaeolithic
Likelihood of Palaeolithic remains	Very low - Lower/Middle Palaeolithic Low - Upper Palaeolithic
Likely importance of Palaeolithic remains	Very low - Lower/Middle Palaeolithic Very high - Upper Palaeolithic
Priorities for evaluation	Lower/Middle Palaeolithic - None Upper Palaeolithic - clarify deposit sequence across area, and investigate for undisturbed knapping scatters
Approaches to evaluation	Lower/Middle Palaeolithic - None Upper Palaeolithic - test pits
Any other comments	Unlikely to contain Lower/Middle Palaeolithic remains; perhaps a low possibility of Late Upper Palaeolithic Long Blade remains, based on other local occurrences [Ebbsfleet Green] from similar situations

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



PP #	PP 13
Summary description	In waste ground (Made ground? Under new landfill mound?) to north and west of station access road
Sediment sequence	Chalk-rich solifluction deposits (Coombe Rock) under between 1 and 2 metres of brickearth along most of the length of the zone; this sequence may be overlain (or truncated) by sand/silt slopewash deposits in places, especially at the eastern end
Sediment depth	Very uncertain; the top surface of the natural sequence probably slopes gently up to the west from c. 10 to 15 m OD; natural deposits may now have been buried by a substantial thickness of made ground (including remediated landfill) during the HS1 development programme.
Palaeolithic artefacts	None known from this zone, although laterally equivalent Coombe Rock deposits have produced Levalloisian material, including the material from RA Smith's original "Baker's Hole" Levalloisian site
Palaeo-environmental remains	The "Baker's Hole" Coombe Rock also contained mammoth, horse, red deer and rhinoceros remains.
Age/correlation	MIS 8 - 6
Palaeolithic potential	MODERATE
Likelihood of Palaeolithic remains	Moderate
Likely importance of Palaeolithic remains	Moderate
Priorities for evaluation	Establish where natural sediments survive; establish their nature and Palaeolithic potential
Approaches to evaluation	Test pit, boreholes
Any other comments	This section was preserved under a conveyor belt, while chalk quarrying took place all around

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



PP #	PP 14a, 14b
Summary description	Part of the Baker's Hole SSSI that is within the Ebbsfleet International station reserved car park. Before the HS1 development, this area was a bank of unquarried ground west of the football pitches behind the Blue Circle pavilion. PP14a represents the majority of this area, which is under the station car park. PP14b represents the strip of wooded ground to the west of the car park that still has a standing southwest-facing section opposite the Baker's Hole Scheduled Monument [Site B]
Sediment sequence	Deep thickness of made ground, but likely to be natural Pleistocene deposits [west side of Ebbsfleet Channel fill] (silts, sands, gravels, Coombe Rock) under the made ground
Sediment depth	Ground surface at c. 12m OD, then probably 2-3m of made ground before reaching natural Ebbsfleet Channel deposits, which then may go down to c. 6m OD at the east side of the area, but rise westwards towards the west channel bank)
Palaeolithic artefacts	Several artefacts provenanced to deposits exposed in the southwest-facing face of PP 14b, and equivalent deposits in the near vicinity [PP 14d-f - Site/Area B] have produced rich and varied remains, including undisturbed Levalloisian horizons
Palaeo-environmental remains	Several fossils [horse and red deer bones, mammoth teeth] provenanced to deposits exposed in the southwest-facing face of PP 14b. Equivalent deposits in the near vicinity [PP 14d-f - Site/Area B] have produced rich and varied mammalian and molluscan remains. A rhino skull whose provenance is uncertain, may well have come from a trial trench dug in this area by G Sieveking in 1969-1970
Age/correlation	MIS 7-2
Palaeolithic potential	HIGH
Likelihood of Palaeolithic remains	High
Likely importance of Palaeolithic remains	High
Priorities for evaluation	Establish distribution and depth of natural Quaternary sediments, and then assess presence/potential of Palaeolithic artefactual and palaeo-environmental remains
Approaches to evaluation	Test pits
Any other comments	Some geotechnical investigations were done for HS1 here, and monitored by Oxford Archaeology [Rob Early], but I've never seen a report on these. If either the original geotechnical report or a report on the archaeological monitoring could be tracked down, I'm sure these would have useful data

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



PP #	PP 14c
Summary description	Area to the south and southwest of the exposed face of PP 14b, extending towards the Scheduled Monument of Area B across (and including) the paved track, up to the upstanding north-east facing edge of area PP 14d.
Sediment sequence	The upper part of the sequence is formed of made ground of uncertain thickness, and includes the old quarry haul road. However natural deposits (silts, sands, gravels, coombe rock) may to be present under the made ground
Sediment depth	The ground surface here is c. 10m OD. The thickness of made ground is unknown, probably c.1- 2m, and under that natural Pleistocene deposits may survive down to c. 6m OD.
Palaeolithic artefacts	None known from deposits in this specific area, but possibly-equivalent deposits in the near vicinity have produced important remains, including diverse palaeo-environmental remains and undisturbed Levalloisian occupation horizons
Palaeo-environmental remains	None reliably provenanced to this specific area, but Pleistocene deposits in the near vicinity have produced rich and varied mammalian remains, including horse and red deer bones, mammoth teeth, and (possibly) a rhino skull whose provenance is uncertain, but which may have come from this area
Age/correlation	MIS 7-2
Palaeolithic potential	HIGH
Likelihood of Palaeolithic remains	High
Likely importance of Palaeolithic remains	High
Priorities for evaluation	Establish distribution and depth of natural Quaternary sediments, and then assess presence/potential of Palaeolithic artefactual and palaeo-environmental remains
Approaches to evaluation	Test pits
Any other comments	Uncertain if any natural deposits survive, and if so at what depth; perhaps the best place to expect the best remains is right under the paved haul road, which might have served to protect natural sediments

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



PP #	PP 14d-f
Summary description	Surviving island of deposits surrounded by landfilled chalk quarries. This is Site/Area B of the Baker's Hole Palaeolithic site complex, and is designated as both a Scheduled Monument and a SSSI. Based on recent fieldwork carried out under the Historic England Heritage-at-Risk programme, it is possible to sub-divide the island into subsidiary areas PP14d-f of differing deposit character, but these fine distinctions are not relevant for this DBA.
Sediment sequence	Base of Pleistocene sequence has chalk-rich colluvial/solifluction deposits overlain by fluvial deposits — silts, sands & gravels; these overlie Chalk bedrock, which rises sharply to the west. These deposits are overlain by colluvial/aeolian sands/silts which are severely truncated in places, but which occur as high as 13m OD at the west side of the zone, wedging out against the rising Chalk; in one place these sands/silts have a weathered palaeo-landsurface developed, overlain by a small remnant of fluvial sands/silts (the Temperate Bed).
Sediment depth	This area contains Pleistocene sediments up to c. 13m OD at the higher west side of the island, where the deposits are about 1m deep. The truncated surface of these deposits descends eastwards across the island to c. 10m OD, and the deposits dip and thicken eastward, with their base at about 6m OD
Palaeolithic artefacts	<ul style="list-style-type: none"> • Mod. common Levalloisian flakes, cores and debitage in the basal chalk-rich colluvial/solifluction deposits • Occasional Levalloisian flakes, cores and debitage in the fluvial sands/gravels over the basal solifluction deposits • Occasional fresh condition artefacts associated with the Temperate Bed and the underlying palaeo-landsurface
Palaeo-environmental remains	Large mammal remains, including rhinoceros and giant deer, have been found throughout the sequence; the Temperate Bed has produced rich small vertebrate and molluscan remains, as well as ostracods
Age/correlation	MIS 7
Palaeolithic potential	VERY HIGH
Likelihood of Palaeolithic remains	Very high
Likely importance of Palaeolithic remains	Very high
Priorities for evaluation	The Heritage-at-Risk programme has already substantially established the answers to key questions about the distribution of deposits, and their vulnerability, particularly for the Temperate Bed. There remain some Qs about the nature and depths of deposits in the eastern part of the area
Approaches to evaluation	Test pits in the eastern part of the site
Any other comments	Previously-exposed old test pits on the area were backfilled with Thanet Sand in December 2015, as a temporary measure (c. 3 year duration) pending development of longer-term management plans for the site.

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



PP #	PP 15
Summary description	Small patch of natural ground preserved just to southwest of Ebbsfleet International
Sediment sequence	Made ground 1-2 m thick overlying varied Pleistocene sequence, generally dipping and thickening northeast, from base: Coombe Rock, gravel (thought to be fluvial), colluvial/slopewash sands/silts/gravels (with bed of tufa in one place)
Sediment depth	Pleistocene deposits between c. 9 and 4 m OD, uncertain thickness of overlying made ground
Palaeolithic artefacts	Flint artefacts (Levalloisian) from slopewash silts/sands/gravels, basal fluvial gravel and Coombe Rock
Palaeo-environmental remains	Molluscs and ostracods in tufa
Age/correlation	MIS 7 through to MIS 2 (Devensian)
Palaeolithic potential	HIGH
Likelihood of Palaeolithic remains	High
Likely importance of Palaeolithic remains	High
Priorities for evaluation	Establish where (and at what depth) natural deposits survive, and assess their nature and Palaeolithic potential
Approaches to evaluation	Test pits
Any other comments	Uncertain how HS1 works have affected this area; probable that natural sediments are now buried by increased thickness of made-up ground

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



PP #	PP 15a
Summary description	Small patch of unquarried ground preserved under old quarry road and Ebbsfleet International access road
Sediment sequence	Made ground of varying thickness (1-2 m thick) overlying Pleistocene deposits that continue towards Site B [PP14d-f] from west end of Jayflex remediation area, from base: Coombe Rock, gravel (thought to be fluvial), sand/silt that could be alluvial and/or colluvial
Sediment depth	Pleistocene deposits between c. 9 and 4 m OD
Palaeolithic artefacts	Flint artefacts (Levalloisian) from historic (Burchell) investigations in generally equivalent deposits in this general area
Palaeo-environmental remains	Mammalian fossils from historic (Burchell) investigations in generally equivalent deposits in this general area
Age/correlation	MIS 7 through to MIS 2 (Devensian)
Palaeolithic potential	HIGH
Likelihood of Palaeolithic remains	High
Likely importance of Palaeolithic remains	High
Priorities for evaluation	Establish where (and at what depth) natural deposits survive, and assess their nature and Palaeolithic potential
Approaches to evaluation	Test pits
Any other comments	This is probably one of the highest potential areas for the possibility of relocating any surviving trace of Burchell's in situ Levallois "floors"

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



8.2 Appendix 2: Zones of Palaeolithic potential (1.nn) along the main road access (eastern route) and the Option 1 people-mover tram/cycle routes in the DBA area.



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5-13	Attribute tables for zones along the bridge/tunnel [B/T] and cycle/tramway Option 1 (CT-1) routes	Separate tables for zones 1.1 through to 1.7



Attribute table structure, and field entry explanations

<i>Attribute</i>	<i>Field entry</i>
Zone #	Zone along routes - see Figure 1
Summary description	Short summary text of geomorphological and topographic situation
Sediment sequence	Description of the Quaternary deposits that may be, or are likely to be, present
Sediment depth	Likely elevation OD of natural sediments, and depth of burial, if known
Palaeolithic artefacts	Description of Palaeolithic artefactual remains that may be, or are likely to be, present
Palaeo-environmental remains	Description of faunal (and other palaeo-environmental) remains that may be, or are likely to be, present
Age/correlation	Presumed/possible age of deposits, and regional correlations to significant deposits, if known
Palaeolithic potential	Attribution based on matrix of likelihood and importance, and supported by brief explanatory text *
Likelihood of Palaeolithic remains	Attribution based on likely type/s of deposit present and previous artefact and palaeo-environmental find records, supported by brief explanatory text *
Likely importance of Palaeolithic remains	Attribution based on likely type/s of deposit present, and supported by brief explanatory text *
Priorities for evaluation	Key questions that need answering, to allow fully-informed consideration of the Palaeolithic potential/importance of the area
Approaches to evaluation	Suitable methods and approaches that could be applied to address the priority evaluation questions specified above
Any other comments	Any particular points not covered by other fields

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Attribute grades for Likelihood and Importance of Palaeolithic remains

<i>Attribution</i>	<i>Likelihood</i>	<i>Importance</i>
VERY HIGH	Certain knowledge of Pleistocene deposits with lithic or palaeo-environmental remains	Nationally important remains: undisturbed occupation surfaces or minimally disturbed artefact concentrations; abundant faunal /palaeo-environmental remains, deposits with key sequences and lithostratigraphic relationships
HIGH	High likelihood of Pleistocene deposits with lithic or palaeo-environmental remains	Undisturbed occupation surfaces or minimally disturbed concentrations; abundant remains from deposits of good stratigraphic and chronological integrity, biological associations; deposits with important lithostratigraphic sequences and relationships
MODERATE	Reasonable likelihood of deposits with remains	Less abundant disturbed artefactual and/or faunal remains from units of reasonable stratigraphic and chronological integrity; deposits with moderate lithostratigraphic sequences and relationship
LOW	Remains are known to occur, but rare	Disturbed remains from deposits of low stratigraphic and chronological integrity; deposits with minimal lithostratigraphic sequences and relationships
VERY LOW	Remains very unlikely to occur	Thought extremely unlikely for there to be any Pleistocene deposits containing remains, any remains found will be residual and reworked
NONE	No possibility of remains	Not applicable
UNCERTAIN	Insufficient information on which to assess likelihood	Insufficient information on which to assess importance



Matrix for assessment of Palaeolithic potential

<i>Palaeolithic potential</i>	<i>Likelihood</i>	<i>Likely importance</i>
VERY HIGH	Very high	High
	High	Very high
HIGH	High	High, Moderate
	Moderate	High
MODERATE	High	Low
	Moderate	Moderate
	Low	Very high, High
LOW	Moderate	Low
	Low	Moderate
	Very low	Very high, High, Moderate,
VERY LOW	Moderate	Very low
	Low, Very low	Low, Very low
NONE	None	na
UNCERTAIN	Uncertain	High, moderate, low or very low
	High, moderate, low or very low	Uncertain



Zone #	1.1 [= PP 13]
Summary description	In waste ground (Made ground? Under new landfill mound?) to north and west of station access road
Sediment sequence	Chalk-rich solifluction deposits (Coombe Rock) under between 1 and 2 metres of brickearth along most of the length of the zone; this sequence may be overlain (or truncated) by sand/silt slopewash deposits in places, especially at the eastern end
Sediment depth	Very uncertain; the top surface of the natural sequence probably slopes gently up to the west from c. 10 to 15 m OD; natural deposits may now have been buried by a substantial thickness of made ground (including remediated landfill) during the HS1 development programme.
Palaeolithic artefacts	None known from this zone, although laterally equivalent Coombe Rock deposits have produced Levalloisian material, including the material from RA Smith's original "Baker's Hole" Levalloisian site
Palaeo-environmental remains	The "Baker's Hole" Coombe Rock also contained mammoth, horse, red deer and rhinoceros remains.
Age/correlation	MIS 8 - 6
Palaeolithic potential	MODERATE
Likelihood of Palaeolithic remains	Moderate
Likely importance of Palaeolithic remains	Moderate
Priorities for evaluation	Establish where natural sediments survive; establish their nature and Palaeolithic potential
Approaches to evaluation	Test pit, boreholes
Any other comments	This section was preserved under a conveyor belt, while chalk quarrying took place all around

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	1.2
Summary description	Old chalk pit, filled with landfill (mixed domestic waste) in 1980s, and then this removed and replaced with sterile made ground ("Jayflex remediation") as part of HS1 works
Sediment sequence	Made ground over chalk bedrock, which contains basal remnants of dry valley channels filled with Pleistocene slopewash/solifluction deposits
Sediment depth	At least 5m of made ground
Palaeolithic artefacts	A few flint artefacts were found in the basal Pleistocene slopewash/solifluction deposits during a Watching Brief for the Jayflex remediation work in 2002
Palaeo-environmental remains	None known
Age/correlation	Pleistocene channels probably formed MIS 8 - MIS 2
Palaeolithic potential	VERY LOW
Likelihood of Palaeolithic remains	Low
Likely importance of Palaeolithic remains	Low
Priorities for evaluation	-
Approaches to evaluation	-
Any other comments	-

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	1.3 [bridge/tunnel =PP 15]
Summary description	Small patch of natural ground preserved just to southwest of Ebbsfleet International
Sediment sequence	Made ground 1-2 m thick overlying varied Pleistocene sequence, generally dipping and thickening northeast, from base: Coombe Rock, gravel (thought to be fluvial), colluvial/slopewash sands/silts/gravels (with bed of tufa in one place)
Sediment depth	Pleistocene deposits between c. 9 and 4 m OD, uncertain thickness of overlying made ground
Palaeolithic artefacts	Flint artefacts (Levalloisian) from slopewash silts/sands/gravels, basal fluvial gravel and Coombe Rock
Palaeo-environmental remains	Molluscs and ostracods in tufa
Age/correlation	MIS 7 through to MIS 2 (Devensian)
Palaeolithic potential	HIGH
Likelihood of Palaeolithic remains	High
Likely importance of Palaeolithic remains	High
Priorities for evaluation	Establish where (and at what depth) natural deposits survive, and assess their nature and Palaeolithic potential
Approaches to evaluation	Test pits
Any other comments	Uncertain how HS1 works have affected this area; probable that natural sediments are now buried by increased thickness of made-up ground

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	1.3 [cycle/tram =PP 15a]
Summary description	Small patch of unquarried ground preserved under old quarry road and Ebbsfleet International access road
Sediment sequence	Made ground of varying thickness (1-2 m thick) overlying Pleistocene deposits that continue towards Site B [PP14d-f] from west end of Jayflex remediation area, from base: Coombe Rock, gravel (thought to be fluvial), sand/silt that could be alluvial and/or colluvial
Sediment depth	Pleistocene deposits between c. 9 and 4 m OD
Palaeolithic artefacts	Flint artefacts (Levalloisian) from historic (Burchell) investigations in generally equivalent deposits in this general area
Palaeo-environmental remains	Mammalian fossils from historic (Burchell) investigations in generally equivalent deposits in this general area
Age/correlation	MIS 7 through to MIS 2 (Devensian)
Palaeolithic potential	HIGH
Likelihood of Palaeolithic remains	High
Likely importance of Palaeolithic remains	High
Priorities for evaluation	Establish where (and at what depth) natural deposits survive, and assess their nature and Palaeolithic potential
Approaches to evaluation	Test pits
Any other comments	This is probably one of the highest potential areas for the possibility of relocating any surviving trace of Burchell's in situ Levallois "floors"

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	1.4
Summary description	Area to east of PP14a, which used to be Blue Circle sports ground football pitches
Sediment sequence	This area is presumed to be mostly made ground, infilling a 19 th century brick pit, then levelled for the football pitches, and then topped with a substantial thickness of made ground as part of the HS1 works. However it is possible that important Pleistocene deposits still survive in places, deeply buried by modern overburden
Sediment depth	Ground surface is c. 12m OD, and there is probably 3-5m of modern made ground across the zone, before reaching the surface of any Pleistocene deposits that may survive
Palaeolithic artefacts	None known
Palaeo-environmental remains	None known
Age/correlation	If any Pleistocene deposits survive, they would be a continuation of the MIS 7 Ebbsfleet Channel deposits of area PP14
Palaeolithic potential	LOW
Likelihood of Palaeolithic remains	Very low
Likely importance of Palaeolithic remains	Moderate
Priorities for evaluation	Establish depth of made ground, and if any Pleistocene deposits survive underneath
Approaches to evaluation	Test pits, boreholes
Any other comments	It may be hard to distinguish between made ground and natural deposits in this area, and from a practical point of view very difficult to carry out any useful work. Some geotechnical investigations were done for HS1 here, and monitored by Oxford Archaeology [Rob Early]. If either the original geotechnical report or a report on the archaeological monitoring could be tracked down, these would have useful data.

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	1.5
Summary description	Used to be the northern side of Blue Circle sports ground football pitches, with a track passing under the Kent railway line, but now built up at the southern end of this zone for the HS1 Ebbsfleet International station car park
Sediment sequence	The southern part of this area is made ground, infilling the southern flank of a dry valley that descends from Swanscombe to the Ebbsfleet alluvial floodplain, after passing through area PP 08. There may be remnants of Holocene alluvium at the east side of the zone, towards the HS 1 track.
Sediment depth	Ground surface is c. 12m OD in the southern part of this zone, with at least 5m of modern made ground, before reaching the surface of any Pleistocene or Holocene deposits that may survive. However the ground surface is lower in the northern part of the zone, and natural deposits may be close beneath the surface.
Palaeolithic artefacts	1 - A very low possibility of reworked Lower/Middle Palaeolithic artefacts from upslope Boyn Hill terrace 2 - A low possibility of relatively undisturbed Upper Palaeolithic artefacts
Palaeo-environmental remains	1 - A very low possibility of reworked Middle Pleistocene fossils from upslope Boyn Hill terrace 2 - A low possibility of relatively undisturbed Upper Palaeolithic faunal remains
Age/correlation	If any Pleistocene deposits survive, they would be a continuation of the MIS 5d-2 dry valley fill sequence
Palaeolithic potential	1 - VERY LOW (Lower/Middle Palaeolithic) 2 - MODERATE (Upper Palaeolithic)
Likelihood of Palaeolithic remains	1 - Moderate 2 - Low
Likely importance of Palaeolithic remains	1 - Very low 2 - Very high
Priorities for evaluation	1 - None 2 - Investigate presence/nature of Quaternary sediments, and for presence of Upper Palaeolithic remains
Approaches to evaluation	-
Any other comments	-

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	1.6 [bridge/tunnel, = PP 07 east side]
Summary description	Unquarried ground [old Northfleet allotments] to west of HS1 and south of Swanscombe-Northfleet footpath; includes part of the Baker's Hole Scheduled Monument and SSSI complex.
Sediment sequence (from base)	<ul style="list-style-type: none"> • Fluvial/alluvial silts, sands & gravels (maybe two phases of terrace deposition) • Marsh deposits (clayey sands and silts) • Colluvial/aeolian deposits (sands/silts)
Sediment depth	Base of Pleistocene sequence probably below 0m OD. Key horizons mostly buried by at least 2m of post MIS5d colluvial sand/silt - except at east side of area, where truncated by sloping west side of HS1 cutting
Palaeolithic artefacts	Few artefacts known, but records of a handaxe and flake from fine-grained loam towards the base of the sequence
Palaeo-environmental remains	Very abundant and well-preserved vertebrate, molluscan and ostracod remains
Age/correlation	MIS 7 interglacial deposits, overlain/abuted by Ipswichian MIS5e deposits, with both these sets of deposits overlain by younger (MIS 5d - MIS 2) slopewash deposits
Palaeolithic potential	VERY HIGH
Likelihood of Palaeolithic remains	Very high
Likely importance of Palaeolithic remains	Very high
Priorities for evaluation	Establish how ZR4 and adjacent 3790 TT sequences relate, what lithostratigraphic variations there are within the zone, and overall Palaeolithic/Pleistocene importance of different deposits present
Approaches to evaluation	Boreholes and test-pits, with a significant degree of palaeo-environmental assessment; geo-physics
Any other comments	This zone is part of the Baker's Hole Scheduled Monument and Site of Special Scientific Interest. It contains palaeo-environmental evidence of different sub-stages of MIS 7, as well MIS 5e and other subsequent periods, which makes it of national importance.

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	1.6 [Option 1 cycle/tram, = PP 07 west of ZR4 pylon]
Summary description	Unquarried ground [old Northfleet allotments] to west of HS1 and south of Swanscombe-Northfleet footpath; includes part of the Baker's Hole Scheduled Monument and SSSI complex.
Sediment sequence (from base)	<ul style="list-style-type: none"> • Fluvial/alluvial silts, sands & gravels (probably several phases of terrace deposition) • Marsh deposits (clayey sands and silts) • Colluvial/aeolian deposits (sands/silts)
Sediment depth	Base of Pleistocene sequence dips down to east from c. 9m to 5m OD. Key horizons mostly buried by at least 2m of unimportant colluvial sand/silt
Palaeolithic artefacts	Few artefacts known, but records of a handaxe and flake from fine-grained loam towards the base of the sequence
Palaeo-environmental remains	Very abundant and well-preserved vertebrate, molluscan and ostracod remains
Age/correlation	MIS 7 interglacial deposits, overlain by younger (MIS 6 - MIS 2) slopewash deposits
Palaeolithic potential	VERY HIGH
Likelihood of Palaeolithic remains	Very high
Likely importance of Palaeolithic remains	Very high
Priorities for evaluation	Establish how Site A and ZR4 sequences relate, what lithostratigraphic variations there are within the zone, and overall Palaeolithic/Pleistocene importance of different deposits present
Approaches to evaluation	Boreholes and test-pits, with a significant degree of palaeo-environmental assessment; geo-physics
Any other comments	This zone is part of the Baker's Hole Scheduled Monument and Site of Special Scientific Interest. It contains palaeo-environmental evidence of different sub-stages of MIS 7, which makes it of national importance.

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	1.7
Summary description	Footpath across north end of PP 07, with old chalk pit further north
Sediment sequence	Natural sediments under/beside old footpath, probably a very thin veneer of slopewash deposits, directly overlying chalk bedrock
Sediment depth	Ground-surface is probably about 10-12m OD, slopewash deposits are probably about 50cm thick.
Palaeolithic artefacts	None known
Palaeo-environmental remains	None known
Age/correlation	Slopewash is probably Last Glacial (MIS 5d-2) or early Holocene
Palaeolithic potential	VERY LOW
Likelihood of Palaeolithic remains	Low
Likely importance of Palaeolithic remains	Very low
Priorities for evaluation	-
Approaches to evaluation	-
Any other comments	This footpath, which continues uphill west into PP 04, provides a valuable transect of the original deposit sequence and surface topography of the west side of the Ebbsfleet Valley, before any quarrying

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



8.3 Appendix 3: Zones of Palaeolithic potential (2.nn) along the Option 2 people-mover tram/cycle routes in the DBA area



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4	Attribute grades for <i>Palaeolithic potential</i>	Tabular overview
5-13	Attribute tables for zones along cycle/tramway Option 2 (CT-2] routes	Separate tables for zones 2.1 through to 2.8



Attribute table structure, and field entry explanations

<i>Attribute</i>	<i>Field entry</i>
Zone #	Zone along routes - see Figure 6
Summary description	Short summary text of geomorphological and topographic situation
Sediment sequence	Description of the Quaternary deposits that may be, or are likely to be, present
Sediment depth	Likely elevation OD of natural sediments, and depth of burial, if known
Palaeolithic artefacts	Description of Palaeolithic artefactual remains that may be, or are likely to be, present
Palaeo-environmental remains	Description of faunal (and other palaeo-environmental) remains that may be, or are likely to be, present
Age/correlation	Presumed/possible age of deposits, and regional correlations to significant deposits, if known
Palaeolithic potential	Attribution based on matrix of likelihood and importance, and supported by brief explanatory text *
Likelihood of Palaeolithic remains	Attribution based on likely type/s of deposit present and previous artefact and palaeo-environmental find records, supported by brief explanatory text *
Likely importance of Palaeolithic remains	Attribution based on likely type/s of deposit present, and supported by brief explanatory text *
Priorities for evaluation	Key questions that need answering, to allow fully-informed consideration of the Palaeolithic potential/importance of the area
Approaches to evaluation	Suitable methods and approaches that could be applied to address the priority evaluation questions specified above
Any other comments	Any particular points not covered by other fields

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Attribute grades for Likelihood and Importance of Palaeolithic remains

<i>Attribution</i>	<i>Likelihood</i>	<i>Importance</i>
VERY HIGH	Certain knowledge of Pleistocene deposits with lithic or palaeo-environmental remains	Nationally important remains: undisturbed occupation surfaces or minimally disturbed artefact concentrations; abundant faunal /palaeo-environmental remains, deposits with key sequences and lithostratigraphic relationships
HIGH	High likelihood of Pleistocene deposits with lithic or palaeo-environmental remains	Undisturbed occupation surfaces or minimally disturbed concentrations; abundant remains from deposits of good stratigraphic and chronological integrity, biological associations; deposits with important lithostratigraphic sequences and relationships
MODERATE	Reasonable likelihood of deposits with remains	Less abundant disturbed artefactual and/or faunal remains from units of reasonable stratigraphic and chronological integrity; deposits with moderate lithostratigraphic sequences and relationship
LOW	Remains are known to occur, but rare	Disturbed remains from deposits of low stratigraphic and chronological integrity; deposits with minimal lithostratigraphic sequences and relationships
VERY LOW	Remains very unlikely to occur	Thought extremely unlikely for there to be any Pleistocene deposits containing remains, any remains found will be residual and reworked
NONE	No possibility of remains	Not applicable
UNCERTAIN	Insufficient information on which to assess likelihood	Insufficient information on which to assess importance



Matrix for assessment of Palaeolithic potential

<i>Palaeolithic potential</i>	<i>Likelihood</i>	<i>Likely importance</i>
VERY HIGH	Very high	High
	High	Very high
HIGH	High	High, Moderate
	Moderate	High
MODERATE	High	Low
	Moderate	Moderate
	Low	Very high, High
LOW	Moderate	Low
	Low	Moderate
	Very low	Very high, High, Moderate,
VERY LOW	Moderate	Very low
	Low, Very low	Low, Very low
NONE	None	na
UNCERTAIN	Uncertain	High, moderate, low or very low
	High, moderate, low or very low	Uncertain



Zone #	2.1 [= PP 13, =1.1]
Summary description	In waste ground (Made ground? Under new landfill mound?) to north and west of station access road
Sediment sequence	Chalk-rich solifluction deposits (Coombe Rock) under between 1 and 2 metres of brickearth along most of the length of the zone; this sequence may be overlain (or truncated) by sand/silt slopewash deposits in places, especially at the eastern end
Sediment depth	Very uncertain; the top surface of the natural sequence probably slopes gently up to the west from c. 10 to 15 m OD; natural deposits may now have been buried by a substantial thickness of made ground (including remediated landfill) during the HS1 development programme.
Palaeolithic artefacts	None known from this zone, although laterally equivalent Coombe Rock deposits have produced Levalloisian material, including the material from RA Smith's original "Baker's Hole" Levalloisian site
Palaeo-environmental remains	The "Baker's Hole" Coombe Rock also contained mammoth, horse, red deer and rhinoceros remains.
Age/correlation	MIS 8 - 6
Palaeolithic potential	MODERATE
Likelihood of Palaeolithic remains	Moderate
Likely importance of Palaeolithic remains	Moderate
Priorities for evaluation	Establish where natural sediments survive; establish their nature and Palaeolithic potential
Approaches to evaluation	Test pit, boreholes
Any other comments	This section was preserved under a conveyor belt, while chalk quarrying took place all around

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	2.2 [=1.2]
Summary description	Old chalk pit, filled with landfill (mixed domestic waste) in 1980s, and then this removed and replaced with sterile made ground ("Jayflex remediation") as part of HS1 works
Sediment sequence	Made ground over chalk bedrock, which contains basal remnants of dry valley channels filled with Pleistocene slopewash/solifluction deposits
Sediment depth	At least 5m of made ground
Palaeolithic artefacts	A few flint artefacts were found in the basal Pleistocene slopewash/solifluction deposits during a Watching Brief for the Jayflex remediation work in 2002
Palaeo-environmental remains	None known
Age/correlation	Pleistocene channels probably formed MIS 8 - MIS 2
Palaeolithic potential	VERY LOW
Likelihood of Palaeolithic remains	Low
Likely importance of Palaeolithic remains	Low
Priorities for evaluation	-
Approaches to evaluation	-
Any other comments	-

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	2.3 [=PP 15a, =1.3 cycle/tram]
Summary description	Small patch of unquarried ground preserved under old quarry road and Ebbsfleet International access road
Sediment sequence	Made ground of varying thickness (1-2 m thick) overlying Pleistocene deposits that continue towards Site B [PP14d-f] from west end of Jayflex remediation area, from base: Coombe Rock, gravel (thought to be fluvial), sand/silt that could be alluvial and/or colluvial
Sediment depth	Pleistocene deposits between c. 9 and 4 m OD
Palaeolithic artefacts	Flint artefacts (Levalloisian) from historic (Burchell) investigations in generally equivalent deposits in this general area
Palaeo-environmental remains	Mammalian fossils from historic (Burchell) investigations in generally equivalent deposits in this general area
Age/correlation	MIS 7 through to MIS 2 (Devensian)
Palaeolithic potential	HIGH
Likelihood of Palaeolithic remains	High
Likely importance of Palaeolithic remains	High
Priorities for evaluation	Establish where (and at what depth) natural deposits survive, and assess their nature and Palaeolithic potential
Approaches to evaluation	Test pits
Any other comments	This is probably one of the highest potential areas for the possibility of relocating any surviving trace of Burchell's in situ Levallois "floors"

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	2.4 [=1.4]
Summary description	Area to east of PP14a, which used to be Blue Circle sports ground football pitches
Sediment sequence	This area is presumed to be mostly made ground, infilling a 19 th century brick pit, then levelled for the football pitches, and then topped with a substantial thickness of made ground as part of the HS1 works. However it is possible that important Pleistocene deposits still survive in places, deeply buried by modern overburden
Sediment depth	Ground surface is c. 12m OD, and there is probably 3-5m of modern made ground across the zone, before reaching the surface of any Pleistocene deposits that may survive
Palaeolithic artefacts	None known
Palaeo-environmental remains	None known
Age/correlation	If any Pleistocene deposits survive, they would be a continuation of the MIS 7 Ebbsfleet Channel deposits of area PP14
Palaeolithic potential	LOW
Likelihood of Palaeolithic remains	Very low
Likely importance of Palaeolithic remains	Moderate
Priorities for evaluation	Establish depth of made ground, and if any Pleistocene deposits survive underneath
Approaches to evaluation	Test pits, boreholes
Any other comments	It may be hard to distinguish between made ground and natural deposits in this area, and from a practical point of view very difficult to carry out any useful work. Some geotechnical investigations were done for HS1 here, and monitored by Oxford Archaeology [Rob Early]. If either the original geotechnical report or a report on the archaeological monitoring could be tracked down, these would have useful data.

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	2.5
Summary description	Used to be the northern side of Blue Circle sports ground football pitches, with a track passing under the Kent railway line, but now built up at the southern end of this zone for the HS1 Ebbsfleet International station car park
Sediment sequence	The southern part of this area is made ground, infilling the southern flank of a dry valley that descends from Swanscombe to the Ebbsfleet alluvial floodplain, after passing through area PP 08.
Sediment depth	Ground surface is c. 12m OD in the southern part of this zone, with at least 5m of modern made ground, before reaching the surface of any Pleistocene or Holocene deposits that may survive. However the ground surface is lower in the northern part of the zone, and natural deposits may be close beneath the surface.
Palaeolithic artefacts	None known
Palaeo-environmental remains	None known
Age/correlation	If any Pleistocene deposits survive, they would be a continuation of the MIS 5d-2 dry valley fill sequence
Palaeolithic potential	VERY LOW
Likelihood of Palaeolithic remains	Very low
Likely importance of Palaeolithic remains	Very low
Priorities for evaluation	-
Approaches to evaluation	-
Any other comments	-

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	2.6
Summary description	Along bottom of slope of grassed-over made-up ground, parallel with west face of PP 07, c. 5-10m to its west
Sediment sequence	Modern made-up ground, mostly domestic landfill from 1970s-1980s, then capped and grassed-over in 1990s
Sediment depth	At least 15m of landfill/made ground, from a ground-surface that slopes down from about 20m OD at the north end of this zone to about 12m at the south end
Palaeolithic artefacts	None
Palaeo-environmental remains	None
Age/correlation	20th century landfill
Palaeolithic potential	NONE
Likelihood of Palaeolithic remains	None
Likely importance of Palaeolithic remains	na
Priorities for evaluation	-
Approaches to evaluation	-
Any other comments	-

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	2.7 [= PP 04, east end]
Summary description	East end of strip of unquarried deposits under footpath that runs east from Swanscombe to Northfleet over HS1, dipping eastward from Boyn Hill terrace down to Ebbsfleet Holocene alluvium
Sediment sequence	Boyn Hill deposits — Lower Gravel (fluvial gravel), Lower Loam (fluvial sand/silt with palaeo-landsurface), Lower Middle Gravel (fluvial gravel), Upper Middle Gravel (fluvial gravel-rich sand) — overlain by slopewash/solifluction deposits. Boyn Hill deposits thin and disappear at east end of zone, truncated by slope of ground surface.
Sediment depth	Boyn Hill deposits between 30 and 23 m OD at the west end of the footpath, and then ground surface steadily dipping down eastward to c. 20m OD at the point where cycle/tram Option 2 crosses PP 04
Palaeolithic artefacts	Clactonian artefacts (flakes, cores and flake-tools) in Lower Gravel and Lower Loam, associated with undisturbed horizons in Lower Loam; Acheulian artefacts (handaxes, flakes and occ. flake-tools) in Lower Middle Gravel, also associated with undisturbed palaeo-landsurfaces; possibly scarce remains in UMG
Palaeo-environmental remains	Large mammalian faunal remains in Lower Gravel, Lower Loam, Lower Middle Gravel; poss. scarce remains in UMG; molluscan and small vertebrate remains present in LG and LL, possibly also in LMG and UMG in undecalcified patches
Age/correlation	MIS 11 (Hoxnian) Boyn Hill deposits, overlain by younger (MIS 10, or even younger) solifluction/slopewash deposits
Palaeolithic potential	MODERATE
Likelihood of Palaeolithic remains	High
Likely importance of Palaeolithic remains	Low
Priorities for evaluation	Establish how far north and south of the footpath natural deposits survive, establish their geological age/nature and whether they can be related to the Boyn Hill terrace sequence, and assess their Palaeolithic potential
Approaches to evaluation	Test pits and boreholes either side of footpath; clean N-facing and S-facing sections below footpath
Any other comments	The east end of PP 04, affected by cycle tram Option 2, is of lower potential than the west end of PP 04, which may preserve an important record of the full Boyn Hill terrace sequence.

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	2.8
Summary description	Old chalk pit, partly backfilled with landfill and made ground
Sediment sequence	Landfill and made ground
Sediment depth	Ground-surface dips to around 10m OD beyond the footpath, and there is probably at least 5-10m, possibly considerably more, of landfill and made ground before solid chalk at the base of the old chalk quarry is reached
Palaeolithic artefacts	None known
Palaeo-environmental remains	None known
Age/correlation	-
Palaeolithic potential	NONE
Likelihood of Palaeolithic remains	None
Likely importance of Palaeolithic remains	na
Priorities for evaluation	-
Approaches to evaluation	-
Any other comments	-

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



8.4 Appendix 4: Zones of Palaeolithic potential (3.nn) along the Option 3 people-mover tram/cycle route in the DBA area



Contents

<i>Page</i>	<i>Details</i>	<i>Notes, comments</i>
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3	Attribute grades for <i>Likelihood</i> and <i>Importance</i> of Palaeolithic remains	Tabular overview
4	Attribute grades for <i>Palaeolithic potential</i>	Tabular overview
5-13	Attribute tables for zones along cycle/tramway Option 2 (CT-2) routes	Separate tables for zones 2.1 through to 2.8



Attribute table structure, and field entry explanations

<i>Attribute</i>	<i>Field entry</i>
Zone #	Zone along routes - see Figure 6
Summary description	Short summary text of geomorphological and topographic situation
Sediment sequence	Description of the Quaternary deposits that may be, or are likely to be, present
Sediment depth	Likely elevation OD of natural sediments, and depth of burial, if known
Palaeolithic artefacts	Description of Palaeolithic artefactual remains that may be, or are likely to be, present
Palaeo-environmental remains	Description of faunal (and other palaeo-environmental) remains that may be, or are likely to be, present
Age/correlation	Presumed/possible age of deposits, and regional correlations to significant deposits, if known
Palaeolithic potential	Attribution based on matrix of likelihood and importance, and supported by brief explanatory text *
Likelihood of Palaeolithic remains	Attribution based on likely type/s of deposit present and previous artefact and palaeo-environmental find records, supported by brief explanatory text *
Likely importance of Palaeolithic remains	Attribution based on likely type/s of deposit present, and supported by brief explanatory text *
Priorities for evaluation	Key questions that need answering, to allow fully-informed consideration of the Palaeolithic potential/importance of the area
Approaches to evaluation	Suitable methods and approaches that could be applied to address the priority evaluation questions specified above
Any other comments	Any particular points not covered by other fields

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Attribute grades for Likelihood and Importance of Palaeolithic remains

<i>Attribution</i>	<i>Likelihood</i>	<i>Importance</i>
VERY HIGH	Certain knowledge of Pleistocene deposits with lithic or palaeo-environmental remains	Nationally important remains: undisturbed occupation surfaces or minimally disturbed artefact concentrations; abundant faunal /palaeo-environmental remains, deposits with key sequences and lithostratigraphic relationships
HIGH	High likelihood of Pleistocene deposits with lithic or palaeo-environmental remains	Undisturbed occupation surfaces or minimally disturbed concentrations; abundant remains from deposits of good stratigraphic and chronological integrity, biological associations; deposits with important lithostratigraphic sequences and relationships
MODERATE	Reasonable likelihood of deposits with remains	Less abundant disturbed artefactual and/or faunal remains from units of reasonable stratigraphic and chronological integrity; deposits with moderate lithostratigraphic sequences and relationship
LOW	Remains are known to occur, but rare	Disturbed remains from deposits of low stratigraphic and chronological integrity; deposits with minimal lithostratigraphic sequences and relationships
VERY LOW	Remains very unlikely to occur	Thought extremely unlikely for there to be any Pleistocene deposits containing remains, any remains found will be residual and reworked
NONE	No possibility of remains	Not applicable
UNCERTAIN	Insufficient information on which to assess likelihood	Insufficient information on which to assess importance



Matrix for assessment of Palaeolithic potential

<i>Palaeolithic potential</i>	<i>Likelihood</i>	<i>Likely importance</i>
VERY HIGH	Very high	High
	High	Very high
HIGH	High	High, Moderate
	Moderate	High
MODERATE	High	Low
	Moderate	Moderate
	Low	Very high, High
LOW	Moderate	Low
	Low	Moderate
	Very low	Very high, High, Moderate,
VERY LOW	Moderate	Very low
	Low, Very low	Low, Very low
NONE	None	na
UNCERTAIN	Uncertain	High, moderate, low or very low
	High, moderate, low or very low	Uncertain



Zone #	3.1 [= PP 13, =1.1, =2.1]
Summary description	In waste ground (Made ground? Under new landfill mound?) to north and west of station access road
Sediment sequence	Chalk-rich solifluction deposits (Coombe Rock) under between 1 and 2 metres of brickearth along most of the length of the zone; this sequence may be overlain (or truncated) by sand/silt slopewash deposits in places, especially at the eastern end
Sediment depth	Very uncertain; the top surface of the natural sequence probably slopes gently up to the west from c. 10 to 15 m OD; natural deposits may now have been buried by a substantial thickness of made ground (including remediated landfill) during the HS1 development programme.
Palaeolithic artefacts	None known from this zone, although laterally equivalent Coombe Rock deposits have produced Levalloisian material, including the material from RA Smith's original "Baker's Hole" Levalloisian site
Palaeo-environmental remains	The "Baker's Hole" Coombe Rock also contained mammoth, horse, red deer and rhinoceros remains.
Age/correlation	MIS 8 - 6
Palaeolithic potential	MODERATE
Likelihood of Palaeolithic remains	Moderate
Likely importance of Palaeolithic remains	Moderate
Priorities for evaluation	Establish where natural sediments survive; establish their nature and Palaeolithic potential
Approaches to evaluation	Test pit, boreholes
Any other comments	This section was preserved under a conveyor belt, while chalk quarrying took place all around

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	3.2 [=1.2, =2.2]
Summary description	Old chalk pit, filled with landfill (mixed domestic waste) in 1980s, and then this removed and replaced with sterile made ground ("Jayflex remediation") as part of HS1 works
Sediment sequence	Made ground over chalk bedrock, which contains basal remnants of dry valley channels filled with Pleistocene slopewash/solifluction deposits
Sediment depth	At least 5m of made ground
Palaeolithic artefacts	A few flint artefacts were found in the basal Pleistocene slopewash/solifluction deposits during a Watching Brief for the Jayflex remediation work in 2002
Palaeo-environmental remains	None known
Age/correlation	Pleistocene channels probably formed MIS 8 - MIS 2
Palaeolithic potential	VERY LOW
Likelihood of Palaeolithic remains	Low
Likely importance of Palaeolithic remains	Low
Priorities for evaluation	-
Approaches to evaluation	-
Any other comments	-

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	3.3 [=PP 15a, =1.3 cycle/tram, =2.3]
Summary description	Small patch of unquarried ground preserved under old quarry road and Ebbsfleet International access road
Sediment sequence	Made ground of varying thickness (1-2 m thick) overlying Pleistocene deposits that continue towards Site B [PP14d-f] from west end of Jayflex remediation area, from base: Coombe Rock, gravel (thought to be fluvial), sand/silt that could be alluvial and/or colluvial
Sediment depth	Pleistocene deposits between c. 9 and 4 m OD
Palaeolithic artefacts	Flint artefacts (Levalloisian) from historic (Burchell) investigations in generally equivalent deposits in this general area
Palaeo-environmental remains	Mammalian fossils from historic (Burchell) investigations in generally equivalent deposits in this general area
Age/correlation	MIS 7 through to MIS 2 (Devensian)
Palaeolithic potential	HIGH
Likelihood of Palaeolithic remains	High
Likely importance of Palaeolithic remains	High
Priorities for evaluation	Establish where (and at what depth) natural deposits survive, and assess their nature and Palaeolithic potential
Approaches to evaluation	Test pits
Any other comments	This is probably one of the highest potential areas for the possibility of relocating any surviving trace of Burchell's in situ Levallois "floors"

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	3.4 [=1.4, =2.4]
Summary description	Area to east of PP14a, which used to be Blue Circle sports ground football pitches
Sediment sequence	This area is presumed to be mostly made ground, infilling a 19 th century brick pit, then levelled for the football pitches, and then topped with a substantial thickness of made ground as part of the HS1 works. However it is possible that important Pleistocene deposits still survive in places, deeply buried by modern overburden
Sediment depth	Ground surface is c. 12m OD, and there is probably 3-5m of modern made ground across the zone, before reaching the surface of any Pleistocene deposits that may survive
Palaeolithic artefacts	None known
Palaeo-environmental remains	None known
Age/correlation	If any Pleistocene deposits survive, they would be a continuation of the MIS 7 Ebbsfleet Channel deposits of area PP14
Palaeolithic potential	LOW
Likelihood of Palaeolithic remains	Very low
Likely importance of Palaeolithic remains	Moderate
Priorities for evaluation	Establish depth of made ground, and if any Pleistocene deposits survive underneath
Approaches to evaluation	Test pits, boreholes
Any other comments	It may be hard to distinguish between made ground and natural deposits in this area, and from a practical point of view very difficult to carry out any useful work. Some geotechnical investigations were done for HS1 here, and monitored by Oxford Archaeology [Rob Early]. If either the original geotechnical report or a report on the archaeological monitoring could be tracked down, these would have useful data.

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	3.5 [=2.5]
Summary description	Used to be the northern side of Blue Circle sports ground football pitches, with a track passing under the Kent railway line, but now built up at the southern end of this zone for the HS1 Ebbsfleet International station car park
Sediment sequence	The southern part of this area is made ground, infilling the southern flank of a dry valley that descends from Swanscombe to the Ebbsfleet alluvial floodplain, after passing through area PP 08.
Sediment depth	Ground surface is c. 12m OD in the southern part of this zone, with at least 5m of modern made ground, before reaching the surface of any Pleistocene or Holocene deposits that may survive. However the ground surface is lower in the northern part of the zone, and natural deposits may be close beneath the surface.
Palaeolithic artefacts	None known
Palaeo-environmental remains	None known
Age/correlation	If any Pleistocene deposits survive, they would be a continuation of the MIS 5d-2 dry valley fill sequence
Palaeolithic potential	VERY LOW
Likelihood of Palaeolithic remains	Very low
Likely importance of Palaeolithic remains	Very low
Priorities for evaluation	-
Approaches to evaluation	-
Any other comments	-

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	3.6 [= PP 07 west side, south end of]
Summary description	South-west corner of unquarried ground [old Northfleet allotments] to west of HS1 and south of Swanscombe-Northfleet footpath; includes part of the Baker's Hole Scheduled Monument and SSSI complex.
Sediment sequence (from base)	<ul style="list-style-type: none"> • Fluvial/alluvial silts, sands & gravels (maybe later MIS 7 phase of terrace deposition) • Marsh deposits (clayey sands and silts) • Colluvial/aeolian deposits (sands/silts)
Sediment depth	Pleistocene sequence between c. 8m and 11m OD. Key horizons mostly buried by 1-2m of post MIS5d colluvial sand/silt
Palaeolithic artefacts	None specifically known from this part of the area A deposit sequence
Palaeo-environmental remains	None specifically known from this part of the area A deposit sequence
Age/correlation	Presumed MIS 7 interglacial deposits, overlain by younger (MIS 5d - MIS 2) slopewash deposits - it is possible that the deposits in this zone are equivalent to the later MIS 7 deposits in the ZR4 sequence
Palaeolithic potential	VERY HIGH
Likelihood of Palaeolithic remains	High
Likely importance of Palaeolithic remains	Very high
Priorities for evaluation	<ul style="list-style-type: none"> - Investigate how deposit character compares with Site A and ZR4 sequences - assess presence/quality/potential of palaeo-environmental remains
Approaches to evaluation	Test pits, with a significant degree of palaeo-environmental assessment
Any other comments	This zone is part of the Baker's Hole Scheduled Monument and Site of Special Scientific Interest. It is uncertain how the deposits here relate to those at Site A and ZR4; resolving this is a key objective of further investigation at the site, which will contribute to improving our overall understanding of the site, and of the MIS 7 interglacial

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	3.7 [= PP 07 west side, main part of]
Summary description	Unquarried ground [old Northfleet allotments] to west of HS1 and south of Swanscombe-Northfleet footpath; includes part of the Baker's Hole Scheduled Monument and SSSI complex.
Sediment sequence (from base)	<ul style="list-style-type: none"> • Fluvial/alluvial silts, sands & gravels (maybe earlier MIS 7 phase of terrace deposition) • Marsh deposits (clayey sands and silts) • Colluvial/aeolian deposits (sands/silts)
Sediment depth	Pleistocene sequence between c. 9m and 15m OD. Key horizons mostly buried by 2-3m of post MIS5d colluvial sand/silt
Palaeolithic artefacts	Few artefacts known, but records of a handaxe and flake from fine-grained loam towards the base of the sequence
Palaeo-environmental remains	Very abundant and well-preserved vertebrate, molluscan and ostracod remains
Age/correlation	MIS 7 interglacial deposits, from the early peak interglacial sub-stage MIS 7e, overlain by younger (MIS 5d - MIS 2) slopewash deposits
Palaeolithic potential	VERY HIGH
Likelihood of Palaeolithic remains	Very high
Likely importance of Palaeolithic remains	Very high
Priorities for evaluation	<ul style="list-style-type: none"> - confirm nature/depth of Pleistocene sequence - assess presence/quality/potential of palaeo-environmental remains from different horizons
Approaches to evaluation	Test-pits, with a significant degree of palaeo-environmental assessment
Any other comments	This zone is part of the Baker's Hole Scheduled Monument and Site of Special Scientific Interest. It is uncertain how the deposits here relate to those further south along the west side of Area A in zone 3.6; resolving this is a key objective of further investigation at the site, which will contribute to improving our overall understanding of the site, and of the MIS 7 interglacial

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



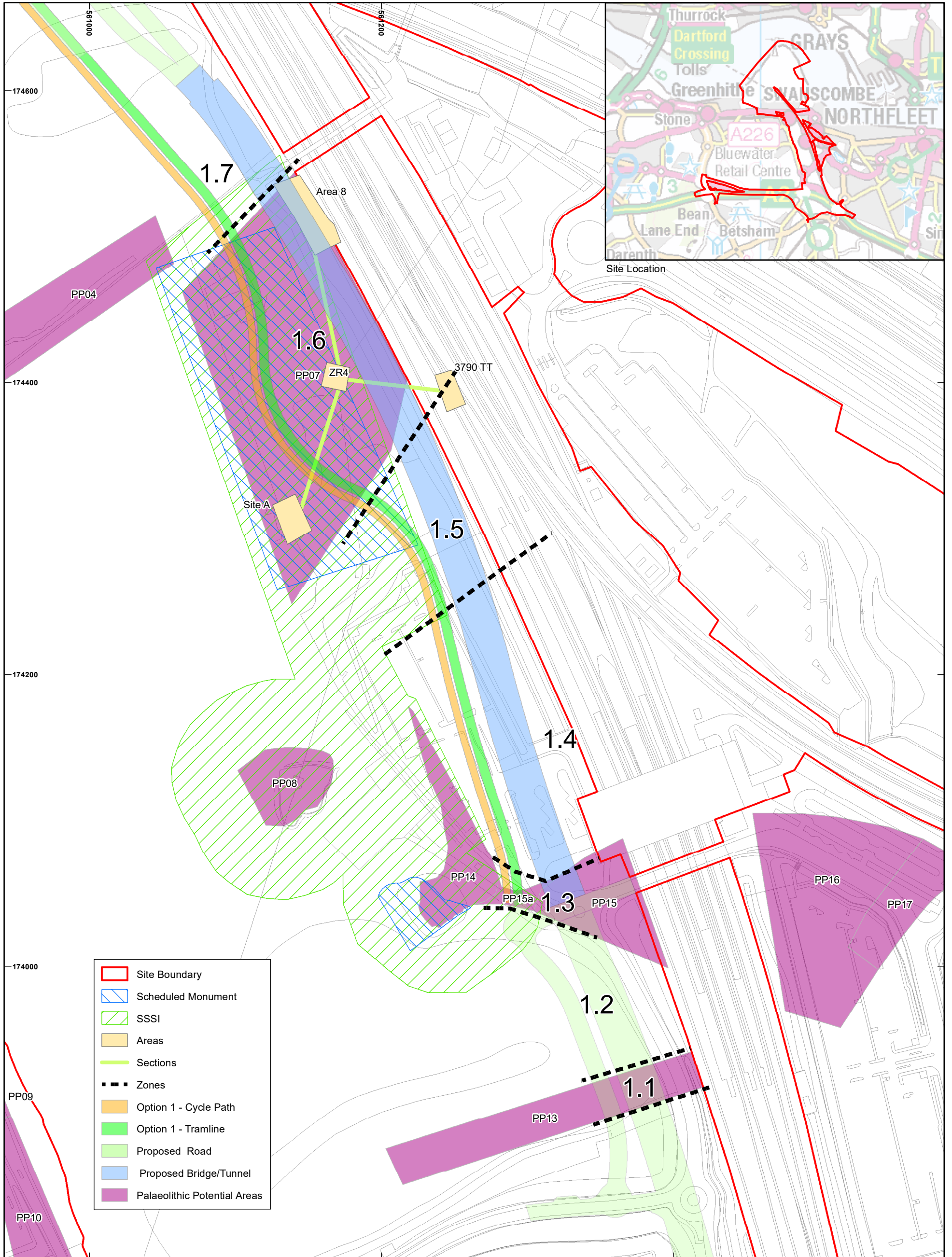
Zone #	3.8 [= PP 07 west side, north end of]
Summary description	North-west corner of Area A Scheduled Monument (beyond north bank of MIS 7 channel-fill), up to and including the footpath from Swanscombe, with the ground-surface probably rising northward within this zone from c. 12 to 15 m OD
Sediment sequence	Natural slopewash sediments, directly overlying chalk bedrock
Sediment depth	Uncertain thickness of slopewash sediments, probably 1-3m
Palaeolithic artefacts	None known
Palaeo-environmental remains	None known
Age/correlation	Slopewash is probably Last Glacial (MIS 5d-2) or early Holocene
Palaeolithic potential	VERY LOW
Likelihood of Palaeolithic remains	Low
Likely importance of Palaeolithic remains	Very low
Priorities for evaluation	Confirm absence of MIS 7 channel-fill deposits, and establish their edge in plan view
Approaches to evaluation	Test pits
Any other comments	<ul style="list-style-type: none">- It is important to establish the location of the northern bank of the MIS 7 channel, to help reconstruct the wider palaeo-landscape- The footpath, which continues uphill west into PP 04, provides a valuable transect of the original deposit sequence and surface topography of the west side of the Ebbsfleet Valley, before any quarrying.

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



Zone #	3.9 [= 2.8]
Summary description	Old chalk pit, partly backfilled with landfill and made ground
Sediment sequence	Landfill and made ground
Sediment depth	Ground-surface dips to around 10m OD beyond the footpath, and there is probably at least 5-10m, possibly considerably more, of landfill and made ground before solid chalk at the base of the old chalk quarry is reached
Palaeolithic artefacts	None known
Palaeo-environmental remains	None known
Age/correlation	-
Palaeolithic potential	NONE
Likelihood of Palaeolithic remains	None
Likely importance of Palaeolithic remains	na
Priorities for evaluation	-
Approaches to evaluation	-
Any other comments	-

* See page 3 for criteria for different categories of likelihood and importance, and then these are combined in a matrix to arrive at an overall assessment of potential



- Site Boundary
- Scheduled Monument
- SSSI
- Areas
- Sections
- Zones
- Option 1 - Cycle Path
- Option 1 - Tramline
- Proposed Road
- Proposed Bridge/Tunnel
- Palaeolithic Potential Areas

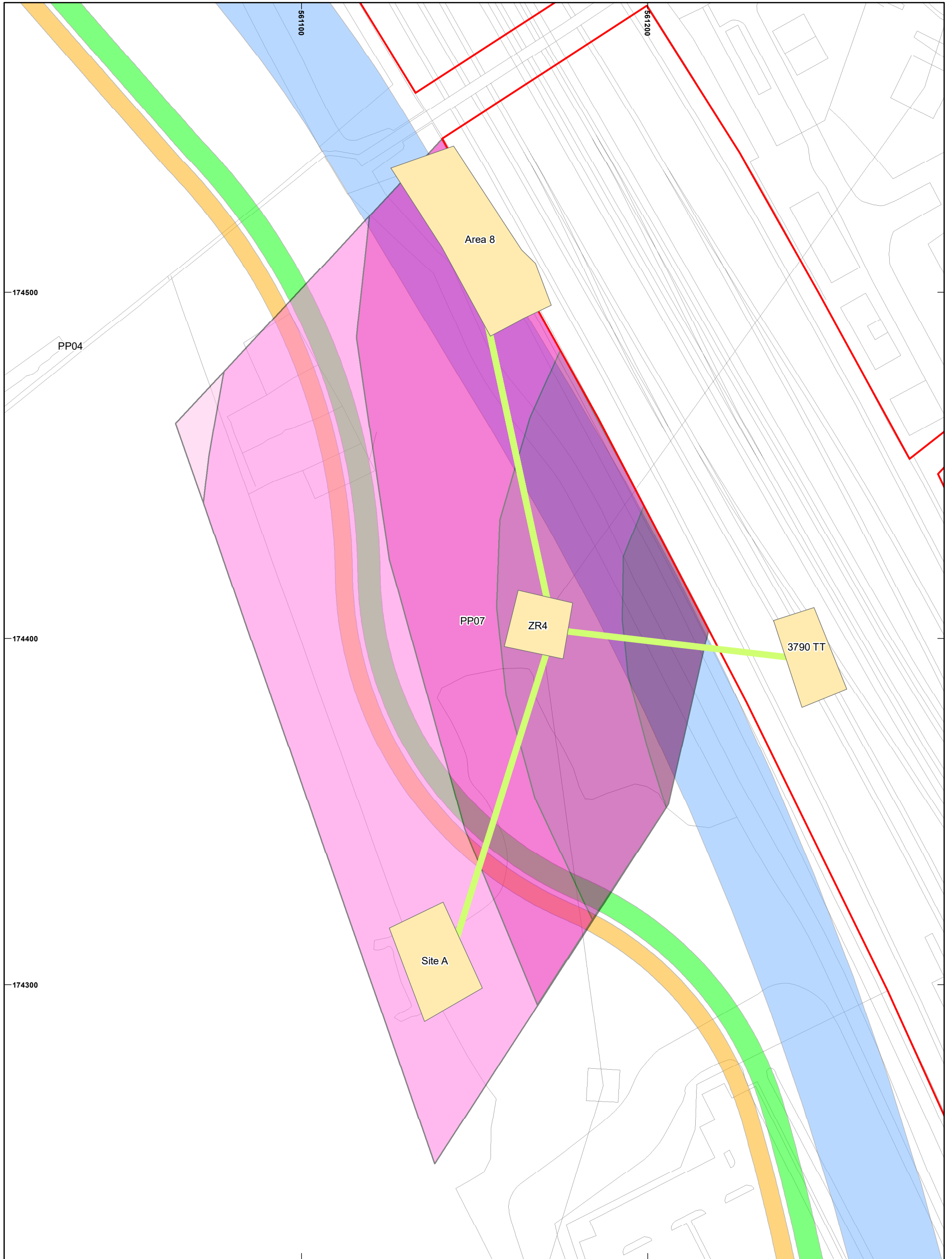


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DBA area: areas of Palaeolithic potential and zones of Palaeolithic impact for Option 1 people-mover route.

Figure 1



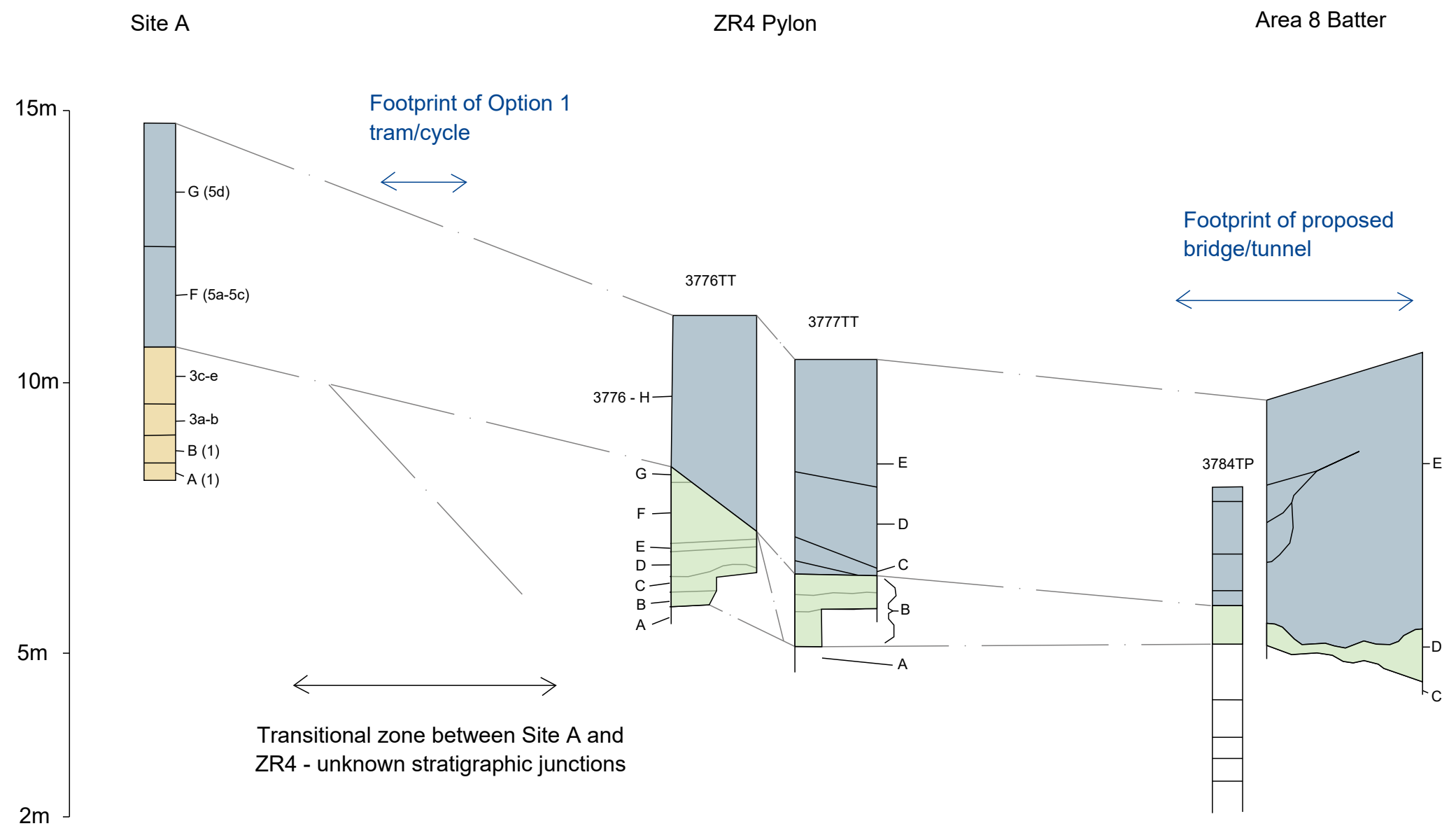
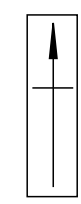
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Palaeolithic area PP07: model of subsidiary areas PP07a-e in relation to access road and people mover-route.

Figure 2

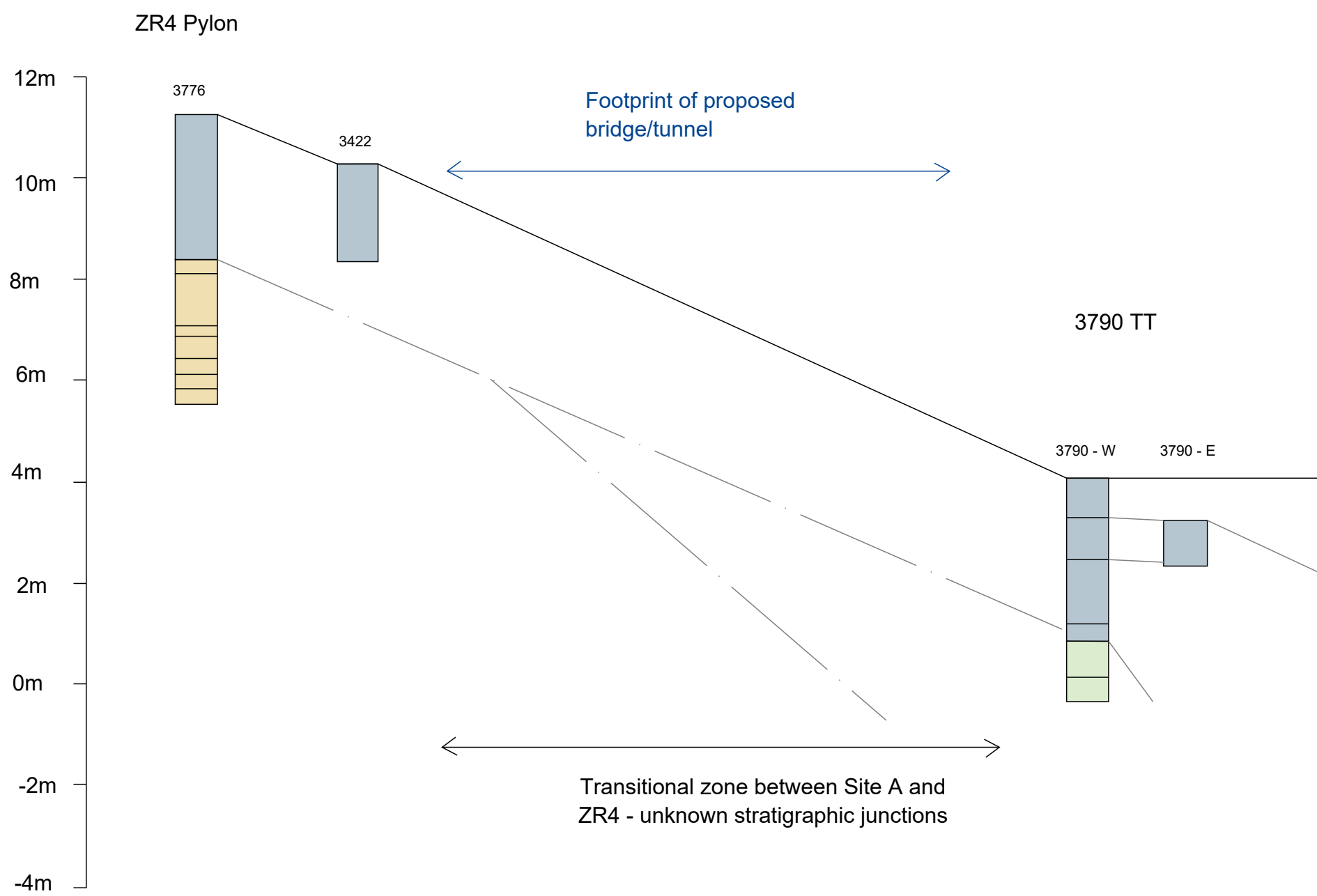


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North-south transect through Palaeolithic area PP07: Site A - ZR4 - Area 8.

Figure 3



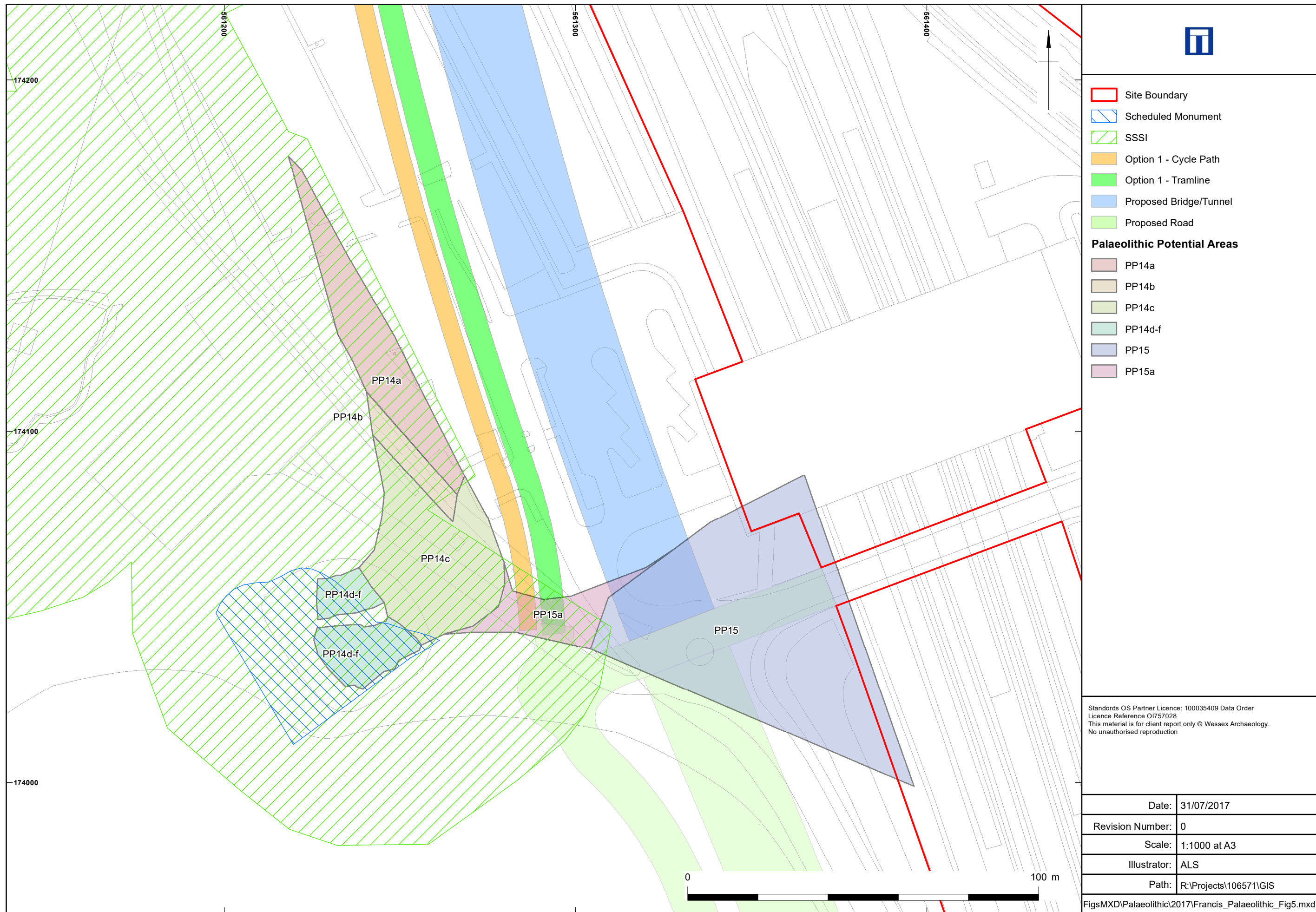
- Silt/sand - low importance
- Clay/silt/sand/gravel - high importance
- Unknown importance

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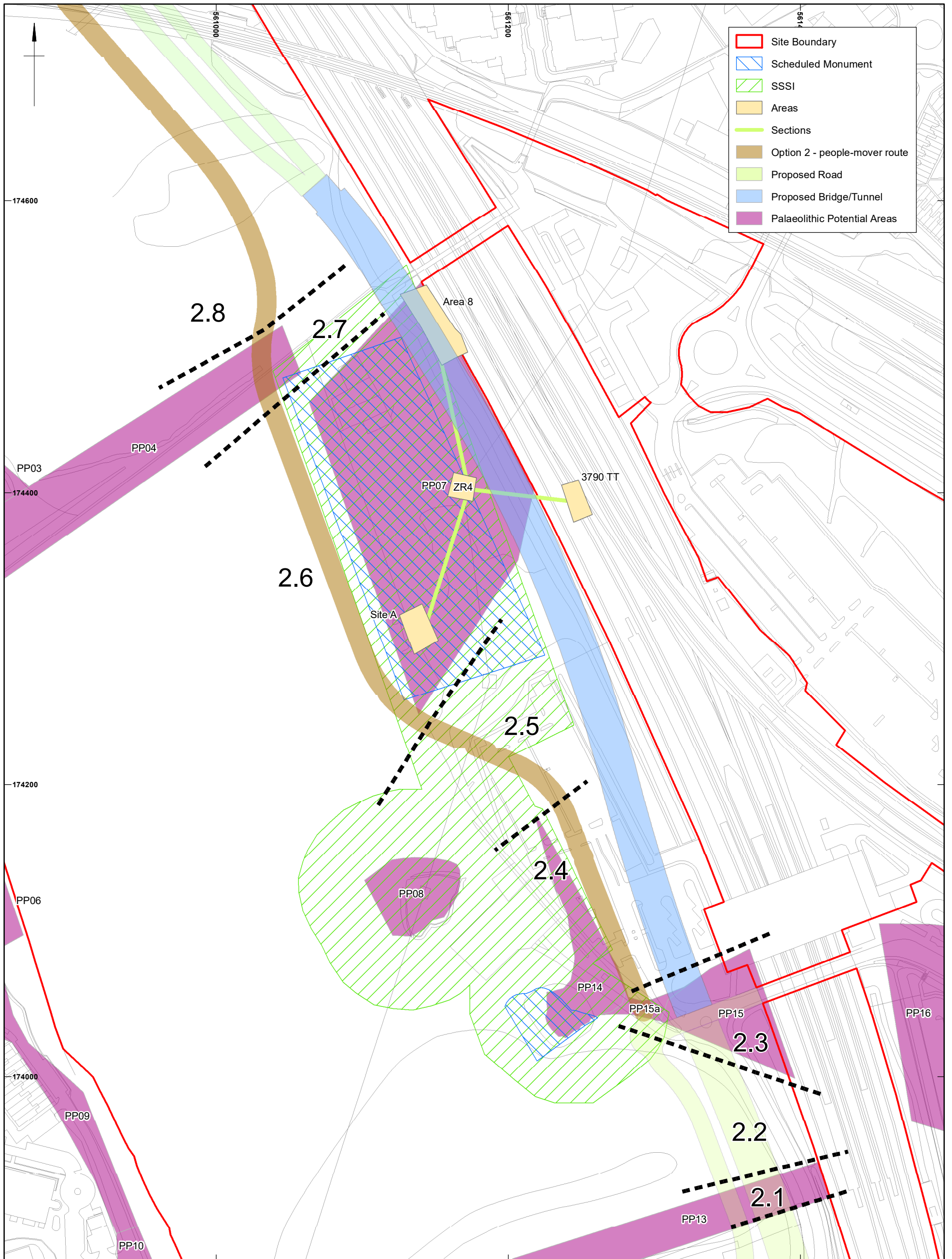
East-west transect through east side of Palaeolithic area PP07: ZR4 - 3790 TT.

Figure 4



Palaeolithic areas PP14-15: subsidiary zones PP14a-F and PP15,15a in relation to access road and Options 1-3 cycle/tram people-mover route.

Figure 5

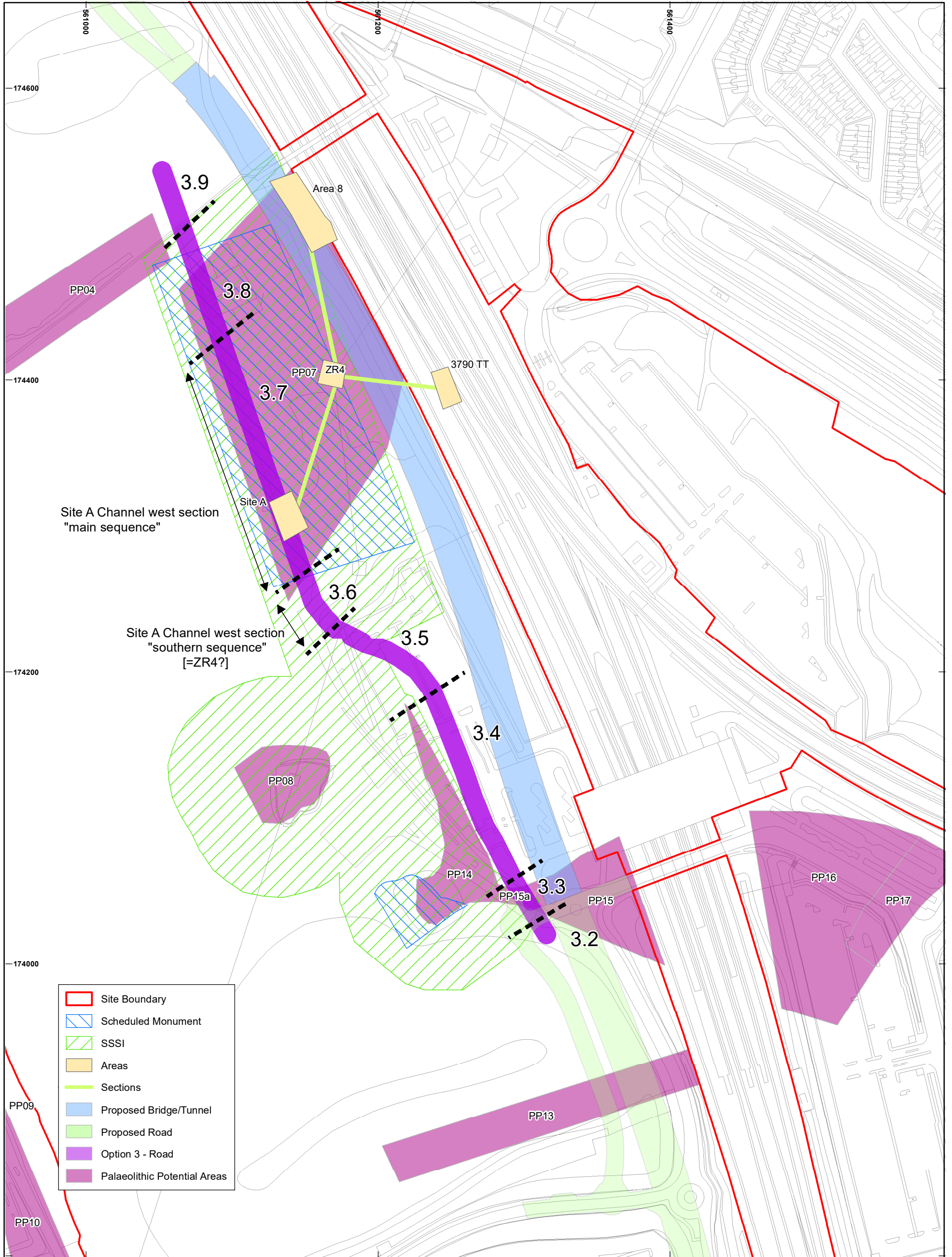


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DBA area: areas of Palaeolithic potential and zones of Palaeolithic impact for Option 2 cycle/tram people-mover route.

Figure 6



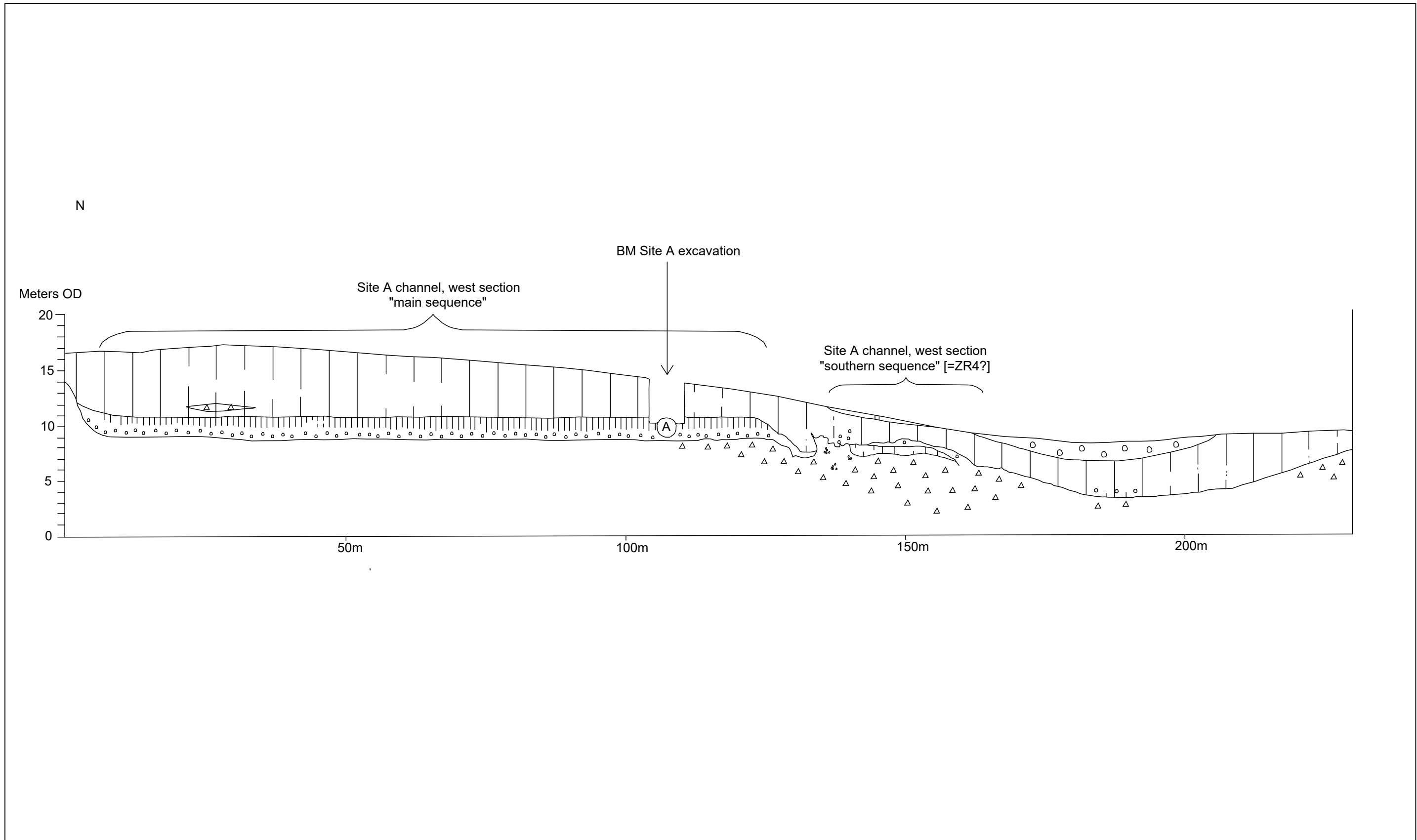
0 250 m



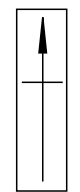
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DBA area: (northern part): areas of Palaeolithic potential and zones of Palaeolithic impact for Option 3 "west-side" cycle/tram people-mover route.



- △ △ Coombe Rock (Chalk Solifluction)
 ||||| Clayey Silt (Alluvial/Marsh-MIS7)
- ○ ○ Sandy Gravel (Solifluction)
 ||||| Silt/Sand (Slopewash-MIS5d-2)
- ● ● ● Sandy Gravel (Fluvial-MIS7)
 ○ ○ Clayey/Silty Gravel (Slopewash)



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Area A: Stratigraphy of west side as recorded in 1965-1970 (Kerney & Sieveking 1977)

Figure 8