

Table 1. Quaternary epochs and the Marine Isotope Stage framework for the Lea Valley study area.

<i>Epoch</i>	<i>Age kBP</i>	<i>MI Stage</i>		<i>Traditional stage (Britain)</i>	<i>Climate</i>	<i>Palaeogeographical events</i>
Holocene	Present–10,000	1	Alluvium	Flandrian	Warm — full interglacial	Thames flowing in present course. Study are part of north bank tributaries flowing southwards
Late Pleistocene	25,000	2	Buried channel	Devensian	Mainly cold; coldest in MI Stage 2 when Britain depopulated and maximum advance of Devensian ice sheets; occasional short-lived periods of relative warmth ("interstadials"), and more prolonged warmth in MI Stage 3.	
	50,000	3	Shepperton			
	70,000	4				
	110,000	5a–d	Kempton Park Gravel	Ipswichian	Warm — full interglacial	
	125,000	5e				
Middle Pleistocene	190,000	6	Taplow Gravel	Wolstonian complex	Alternating periods of cold and warmth; recently recognised that this period includes more than one glacial–interglacial cycle; changes in faunal evolution and assemblage associations through the period help distinguish its different stages.	
	240,000	7				
	300,000	8				
	340,000	9				
	380,000	10				
	425,000	11	Hoxnian	Warm — full interglacial		
	480,000	12	Lowestoft Formation	Anglian	Cold — maximum extent southward of glacial ice in Britain; may incorporate interstadials that have been confused with Cromerian complex interglacials	Major glaciation: Thames blocked by ice in Vale of St.Albans: major drainage modification
	620,000	13–16	(Dollis Hill Gravel – MIS 14)	Cromerian complex and Beestonian glaciation	Cycles of cold and warmth; still poorly understood due to obliteration of sediments by subsequent events	Thames flowing to NE through St.Albans. Study areas part of south bank tributaries flowing northwards
	780,000	17–19	Kesgrave Formation			
Early Pleistocene	1,800,000	20–64			Cycles of cool and warm, but generally not sufficiently cold for glaciation in Britain	

Table 2. Geomorphic elements and evolution, depositional environments, post-depositional factors and archaeological preservation issues for the main lithostratigraphic elements in the Lea Valley study area.

Geomorphic element	Depositional environment type	Geomorphic evolution	Post depositional environmental factors	Archaeological preservation issues
Kesgrave Formation (MIS 13-?22)	High energy river systems with non-cohesive channel banks with potential for lower energy river systems with cohesive channel banks and overbank flooding.	Episodic incision and aggradation of coarse grained sequences (sands/gravels). Sedimentation within braided systems resulting in stacked sequences of cut/fill form. Dominant lateral migration of sequences within overall sediment body.	Major erosion caused by fluvial incision and downcutting creating terraces in pre-diversion Thames system followed by glacial over-riding and modification. Post glacial (Anglian) weathering and colluviation.	<i>In situ</i> and reworked (through terrace systems) Lower Palaeolithic artefacts within main sediment body. Incision may lead to dewatering of sediments and through time decalcification of deposits lowering palaeoenvironmental potential. Surface of deposits may have concatenated sequences of Lower Palaeolithic to modern date.
Lowestoft Formation (MIS 12)	Glacial conditions with major ice bodies in sub-glacial or ice-sheet margin situations. High energy water flow and chaotic moraine dumps.	Till forming in ice marginal conditions during ice advance and sub-glacially during ice retreat phases. Localised lake formation in ice dammed locations.	Incised by south flowing tributaries of the diverted Thames. Weathering and colluviation of remnants.	Reworked Lower Palaeolithic artefacts within main sediment body. Surface of deposits may have concatenated sequences of Lower Palaeolithic to modern date.
Taplow Gravel (MIS 6-8)	High energy river systems with non-cohesive channel banks with potential for lower energy river systems with cohesive channel banks and overbank flooding.	Episodic incision and aggradation of coarse grained sequences (sands/gravels). Sedimentation within braided systems resulting in stacked sequences of cut/fill form. Dominant lateral migration of sequences within overall sediment body. Fine grained accretion within overbank situations during temperate episodes associated with meandering/anastomosing river system.	Sequences eroded through downcutting and left as terraced forms in post-diversion Thames system. Weathering and erosion (colluvial activity) on terrace edges.	<i>In situ</i> and reworked (through terrace systems) Lower Palaeolithic and Middle Palaeolithic artefacts. Incision may lead to dewatering of sediments and through time decalcification of deposits lowering palaeoenvironmental potential. Surface of deposits may have concatenated sequences of Lower Palaeolithic to modern date.
Kempton Park Gravel (MIS 4-6)	High energy river systems with non-cohesive channel banks with potential for lower energy river systems with cohesive channel banks and overbank flooding.	Episodic incision and aggradation of coarse grained sequences (sands/gravels). Sedimentation within braided systems resulting in stacked sequences of cut/fill form. Dominant lateral migration of sequences within overall sediment body. Fine grained accretion within overbank situations during temperate episodes associated with meandering/anastomosing river system.	Sequences eroded through downcutting and left as terraced forms in post-diversion Thames system. Weathering and erosion (colluvial activity) on terrace edges.	<i>In situ</i> and reworked (through terrace systems) Middle Palaeolithic artefacts (also occasional reworked Lower Palaeolithic artefacts). Incision may lead to dewatering of sediments and through time decalcification of deposits lowering palaeoenvironmental potential. Surface of deposits may have concatenated sequences of Lower Palaeolithic to modern date. Possible presence of rafts of sediments (including peats) resulting from incorporation in floating ice (Lea Valley Arctic Beds).

Shepperton Gravel (MIS 2)	High energy river systems with non-cohesive channel banks.	Episodic incision and aggradation of coarse grained sequences (sands/gravels). Sedimentation within braided systems resulting in stacked sequences of cut/fill form. Dominant lateral migration of sequences within overall sediment body.	Sequences buried by accumulation of Holocene alluvium.	Predominantly reworked Lower and Middle Palaeolithic artefacts. Surface of deposits may have late Palaeolithic material resting on surface. Possible presence of rafts of sediments (including peats) resulting from incorporation in floating ice (Lea Valley Arctic Beds).
Holocene alluvium (MIS 1)	Low to moderate energy river systems with cohesive banks and marsh development or floodplain conditions away from river.	Evolution of late glacial braided to Holocene anastomosing river with vertical accretion of sediment through time. Channel position becoming stable. Fine grained sediments predominate including biogenics (tufa/peat)	Some lateral erosion. Local water table fluctuations modify local conditions.	Range of later Prehistoric and Historical archaeological materials in situ on basal gravels or within landscape features associated with human activity. Much material may be <i>in situ</i> but reworking also apparent.

Table 3. Geomorphological and sediment characteristics for zones I – XIX.

Zone	Geomorphological characteristics	Sediment characteristics	Mapped sediments	Likely sequences present
I	Valley floor, dominated by meandering channels, canalized channels and low slope angles (<1°)	Floodplain fines (clays/silts/sands and organics) over gravels and sands. Area of deep basin like feature in gravel surface topography.	Alluvium	Alluvium of Holocene date overlying gravels of Late Devensian date (Lea Valley Gravel)
II	Valley floor, dominated by meandering channels, canalized channels and low slope angles (<1°)	Floodplain fines (clays/silts/sands and organics) over gravels and sands	Alluvium	Alluvium of Holocene date overlying gravels of Late Devensian date (Lea Valley Gravel)
III	Valley floor, dominated by meandering channels, canalized channels and low slope angles (<1°)	Floodplain fines (clays/silts/sands and organics) over gravels and sands	Alluvium	Alluvium of Holocene date overlying gravels of Late Devensian date (Lea Valley Gravel). Towards edge gravels of the Kempton Park Gravel (earlier part of Devensian) may exist beneath the alluvium
IV	Valley edge, low lying topography (<3°)	Thin veneer of fine clays-silts overlying sands and gravels	Kempton Park Gravel Formation	Much of area will consist of early to mid Devensian sand and silts over gravels but thin spreads of Holocene alluvium may also be present
V	Valley edge, low lying topography (<3°)	Thin veneer of fine clays-silts overlying sands and gravels	Kempton Park Gravel Formation	Much of area will consist of early to mid Devensian sand and silts over gravels
VI	Valley side, low lying topography (<3°)	Fine grained clays-silts.	Enfield Silt Formation	Mid to Late Devensian silt probably overlying older gravels of the Kempton Park Gravel Formation
VII	Valley side	Bedrock at surface	Bedrock (various)	Eroding bedrock
VIII	Valley side, low lying topography (<3°)	Fine grained clays-silts.	Enfield Silt Formation	Silt possibly of multi-period formation overlying gravels of the Kempton Park Gravel Formation (downslope) and Taplow Gravel Formation (upslope)
IX	Valley side	Sands and gravels	Taplow Gravel	MIS 6-4 cold stage gravels and possible warm

			Formation	interglacial silts
X	Valley side	Fine grained clays-silts.	Enfield Silt Formation	Silt possibly of multi-period formation overlying gravels of the Taplow Gravel Formation (upslope)
XI	Valley floors in tributary valleys	Coarse gravel and sand overlain by fine grained clay-silts	Alluvium	Probably late Devensian gravels beneath Holocene silts. Elements of colluvium probably also present
XII	Valley tops/plateau margins	Clays with poorly sorted gravels	Lowestoft Foramtion	Mixed packages of clay dominated till, coarse gravels intermittently present. Of Anglian date
XIII	Valley floors in tributary valleys	Coarse gravel and sand overlain by fine grained clay-silts	Alluvium	Probably late Devensian gravels beneath Holocene silts. Elements of colluvium probably also present
XIV	Valley tops/plateaus	Sands and gravels	Kesgrave Formation	Stratified sands and gravels with Pre-Anglian Thames deposits
XV	Valley tops/plateaus	Sands and gravels	Dollis Hill Gravel Formation	
XVI	Valley side	Sands and gravels	Taplow Gravel Formation	MIS 6-4 cold stage gravels and possible warm interglacial silts
XVII	Valley side	Fine grained clays-silts.	Enfield Silt Formation	Silt possibly of multi-period formation overlying gravels of the Kempton Park Gravel Formation (upslope), through the Taplow Gravel Formation to the Kesgrave Gravel Formation.
XVIII	Upper Valley side	Sand and gravel	Unknown	Possible fluvial sands and gravels
XIX	Valley floor, dominated by meandering channels, canalized channels and low slope angles (<1°). River confluence zone	Floodplain fines (clays/silts/sands and organics) over gravels and sands	Alluvium	Alluvium of Holocene date overlying gravels of Late Devensian date (Lea Valley Gravel). Towards edge gravels of the Kempton Park Gravel (earlier part of Devensian) may exist beneath the alluvium

Table 6. SMR/HER records by geoarchaeological zone in the Lea Valley study area.

[illegible]

Table 7. SMR/HER records by geoarchaeological zone in the Lea Valley study area: percentage of period types by zone.

Zone	Number of records	Palaeolithic	Mesolithic	Neolithic	Bronze Age	Iron Age	Prehistoric	Roman	Saxon	Medieval	Post-Medieval	Modern	Unknown
I	17	0	0	0	0	0	0	0	0	11.8	70.8	17.6	0
II	17	0	11.8	0	0	11.8	5.8	35.3	11.8	0	0	0	23.5
III	18	0	0	0	0	5.6	16.7	5.6	5.6	33.3	22.2	11.1	0
IV	17	0	0	0	0	5.9	0	11.8	0	11.8	52.9	0	17.6
V	15	0	0	6.7	0	0	0	13.3	0	0	80	0	0
VI	22	4.5	9.1	0	13.6	4.5	0	0	0	40.9	22.7	4.5	0
VII	33	0	0	0	0	0	0	0	0	15.2	27.3	39.4	18.2
VIII	25	4	4	4	16	0	8	0	0	8	44	12	0
IX	10	10	0	0	0	10	0	10	0	30	10	20	10
X	8	12.5	0	37.5	25	0	0	0	0	12.5	12.5	0	0
XI	5	0	0	0	0	0	0	0	0	0	80	0	20
XII	1	0	0	0	0	0	0	0	0	100	0	0	0
XIII	2	0	0	0	0	0	0	0	0	100	0	0	0
XIV	43	0	0	2.3	0	7	4.7	16.3	0	20.9	37.2	4.7	7
XV	0	0	0	0	0	0	0	0	0	0	0	0	0
XVI	19	0	0	0	0	0	0	10.5	5.3	5.3	68.4	10.5	0
XVII	0	0	0	0	0	0	0	0	0	0	0	0	0
XVIII	0	0	0	0	0	0	0	0	0	0	0	0	0
XIX	6	0	0	0	0	0	0	0	0	0	50	33.3	16.7

Table 8. Density of sites by period zone for the Lea Valley study area.

Zone	Area	Palaeolithic	Mesolithic	Neolithic	Bronze Age	Iron Age	Prehistoric	Roman	Saxon	Medieval	Post Medieval	Modern	Unknown
I	1.88	0	0	0	0	0	0	0	0	1.0638298	6.3829787	1.5957447	1.5957447
II	6.16	0	0.3246753	0	0	0.3246753	0.1623377	0.974026	0.3246753	0	0	0	0
III	3.78	0	0	0	0	0.2645503	0.7936508	0.2645503	0.2645503	1.5873016	1.0582011	0.5291005	0.5291005
IV	3.42	0	0	0	0	0.2923977	0	0.5847953	0	0.5847953	2.6315789	0	0
V	2.53	0	0	0.3952569	0	0	0	0.7905138	0	0	4.743083	0	0
VI	3.79	0.2638522	0.5277045	0	0.7915567	0.2638522	0	0	0	2.3746702	1.3192612	0.2638522	0.2638522
VII	13.5	0	0	0	0	0	0	0	0	0.3703704	0.6666667	0.962963	0.962963
VIII	2.57	0.3891051	0.3891051	0.3891051	1.5564202	0	0.7782101	0	0	0.7782101	4.2801556	1.1673152	1.1673152
IX	1.09	0.9174312	0	0	0	0.9174312	0	0.9174312	0	2.7522936	0.9174312	1.8348624	1.8348624
X	1.39	0.7194245	0	2.1582734	1.4388489	0	0	0	0	0.7194245	0.7194245	0	0
XI	0.18	0	0	0	0	0	0	0	0	0	22.222222	0	0
XII	1.81	0	0	0	0	0	0	0	0	0.5524862	0	0	0
XIII	0.48	0	0	0	0	0	0	0	0	4.1666667	0	0	0
XIV	4.2	0	0	0.2380952	0	0.7142857	0.4761905	1.6666667	0	2.1428571	3.8095238	0.4761905	0.4761905
XV	0.13	0	0	0	0	0	0	0	0	0	0	0	0
XVI	1.79	0	0	0	0	0	0	1.1173184	0.5586592	0.5586592	7.2625698	1.1173184	1.1173184
XVII	0.34	0	0	0	0	0	0	0	0	0	0	0	0
XVIII	0.07	0	0	0	0	0	0	0	0	0	0	0	0
XIX	0.85	0	0	0	0	0	0	0	0	0	3.5294118	2.3529412	2.3529412

Table 10. Geomorphic elements and evolution, depositional environments, post-depositional factors and archaeological preservation issues for the main lithostratigraphic elements in the Ver Valley study area.

Geomorphic element	Depositional environment type	Geomorphic evolution	Post depositional environmental factors	Archaeological preservation issues
Clay-with-flints (Tertiary to present)	Clay-with-flints is a 'remanié' deposit formed by <i>in situ</i> weathering and solifluction of pre-existing Palaeogene and earlier Quaternary deposits.	Periodic weathering producing the reddened appearance and periglacial climate resulting in cryoturbation and mixing	Weathering and fissuring caused by permafrost conditions. Also solution of the underlying chalk bedrock	Concatenated sequences of material from Lower Palaeolithic to recent. Some material may be almost <i>in situ</i> .
Kesgrave Formation (MIS 13-?22)	High energy river systems with non-cohesive channel banks with potential for lower energy river systems with cohesive channel banks and overbank flooding.	Episodic incision and aggradation of coarse grained sequences (sands/gravels). Sedimentation within braided systems resulting in stacked sequences of cut/fill form. Dominant lateral migration of sequences within overall sediment body.	Major erosion caused by fluvial incision and downcutting creating terraces in pre-diversion Thames system followed by glacial over-riding and modification. Post glacial (Anglian) weathering and colluviation.	<i>In situ</i> and reworked (through terrace systems) Lower Palaeolithic artefacts within main sediment body. Incision may lead to dewatering of sediments and through time decalcification of deposits lowering palaeoenvironmental potential. Surface of deposits may have concatenated sequences of Lower Palaeolithic to modern date.
Lowestoft Formation (MIS 12)	Glacial conditions with major ice bodies in sub-glacial or ice-sheet margin situations. High energy water flow and chaotic moraine dumps.	Till forming in ice marginal conditions during ice advance and sub-glacially during ice retreat phases. Localised lake formation in ice dammed locations.	Incised by south flowing tributaries of the diverted Thames. Weathering and colluviation of remnants.	Reworked Lower Palaeolithic artefacts within main sediment body. Surface of deposits may have concatenated sequences of Lower Palaeolithic to modern date.
River terrace deposits (age unknown) in places overlain by Enfield Silt	High energy river systems with non-cohesive channel banks with potential for lower energy river systems with cohesive channel banks and overbank flooding.	Episodic incision and aggradation of coarse grained sequences (sands/gravels). Sedimentation within braided systems resulting in stacked sequences of cut/fill form. Dominant lateral migration of sequences within overall sediment body. Fine grained accretion within overbank situations during temperate episodes associated with meandering/anastomosing river system.	Sequences eroded through downcutting and left as terraced forms in post-diversion Thames system. Weathering and erosion (colluvial activity) on terrace edges.	<i>In situ</i> and reworked (through terrace systems) Lower Palaeolithic and Middle Palaeolithic artefacts (depending on age of sediments). Incision may lead to dewatering of sediments and through time decalcification of deposits lowering palaeoenvironmental potential. Surface of deposits may have concatenated sequences of Lower Palaeolithic to modern date.
Valley bottom gravel (MIS 2)	High energy river systems with non-cohesive channel banks.	Episodic incision and aggradation of coarse grained sequences (sands/gravels). Sedimentation within braided systems resulting in stacked sequences of cut/fill form. Dominant lateral migration of sequences within overall sediment body.	Sequences buried by accumulation of Holocene alluvium.	Predominantly reworked Lower and Middle Palaeolithic artefacts. Surface of deposits may have late Palaeolithic material resting on surface.

Holocene alluvium (MIS 1)	Low to moderate energy river systems with cohesive banks and marsh development or floodplain conditions away from river.	Evolution of late glacial braided to Holocene anastomosing river with vertical accretion of sediment through time. Channel position becoming stable. Fine grained sediments predominate including biogenics (tufa/peat)	Some lateral erosion. Local water table fluctuations modify local conditions.	Range of later Prehistoric and Historical archaeological materials in situ on basal gravels or within landscape features associated with human activity. Much material may be <i>in situ</i> but reworking also apparent.
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Table 11. Quaternary epochs and the Marine Isotope Stage framework for the Ver Valley study area.



<i>Epoch</i>	<i>Age kBP</i>	<i>MI Stage</i>		<i>Traditional stage (Britain)</i>	<i>Climate</i>	<i>Palaeogeographical events</i>
Holocene	Present–10,000	1	Alluvium	Flandrian	Warm — full interglacial	Thames flowing in present course. Study are part of north bank tributaries flowing southwards
Late Pleistocene	25,000	2	Buried channel	Devensian	Mainly cold; coldest in MI Stage 2 when Britain depopulated and maximum advance of Devensian ice sheets; occasional short-lived periods of relative warmth ("interstadials"), and more prolonged warmth in MI Stage 3.	
	50,000	3	Valley bottom gravels 			
	70,000	4				
	110,000	5a–d				
	125,000	5e				
Middle Pleistocene	190,000	6	?	Wolstonian complex	Alternating periods of cold and warmth; recently recognised that this period includes more than one glacial–interglacial cycle; changes in faunal evolution and assemblage associations through the period help distinguish its different stages.	
	240,000	7				
	300,000	8				
	340,000	9				
	380,000	10				
	425,000	11		Hoxnian	Warm — full interglacial	
	480,000	12		Anglian	Cold — maximum extent southward of glacial ice in Britain; may incorporate interstadials that have been confused with Cromerian complex interglacials	Major glaciation: Thames blocked by ice in Vale of St.Albans: major drainage modification
		620,000				
						780,000
Early Pleistocene	1,800,000	20–64	Clay-with-flints 	Cycles of cool and warn, but generally not sufficiently cold for glaciation in Britain	Human activity at Pakefield in East Anglia	
	Late Pliocene	>1.8mya				

Table 4. Quarrying statistics for Lea Valley study area.

Zone	Area (km)	Area lost	% Area lost
I	1.88	0.25	13.3
II	6.16	2.34	38
III	3.78	0.39	10.3
IV	3.42	0.01	0.3
V	2.53	0.09	1
VI	3.79	0.64	16.9
VII	13.5	0.01	0.7
VIII	2.57	0.08	3.1
IX	1.09	0.1	9.2
X	1.39	0	0
XI	0.18	0	0
XII	1.81	0	0
XII	0.48	0.01	2.1
XIV	4.2	0.05	1.2
XV	0.13	0.5	0
XVI	1.79	0.09	5
XVII	0.34	0.01	0
XVIII	0.07	0	0
XIX	0.85	0.2	23.5

Table 5. A: Quarrying statistics for Lea Valley study area by grouped zones. **B:** by period

	Zone	Area (km)	Area lost	% Area lost
Valley Floor zones	I	1.88	0.25	13.3
	II	6.16	2.34	38
	III	3.78	0.39	10.3
	XIII	0.48	0.01	2.1
	XI	0.18	0	0
	XIX	0.85	0.2	23.5
Valley Edge/ Marginal Zones	IV	3.42	0.01	0.3
	V	2.53	0.09	1
	VI	3.79	0.64	16.9
	VII	13.5	0.01	0.7
	IX	1.09	0.1	9.2
	X	1.39	0	0
	XVI	1.79	0.09	5
	XVII	0.34	0.01	0
	XVIII	0.07	0	0
Plateau zones	XII	1.81	0	0
	XIV	4.2	0.05	1.2
	XV	0.13	0.5	0

	Zone	Area (km)	Area lost	% Area lost
Pre-Anglian	XII	1.81	0	0
	XIV	4.2	0.05	1.2
	XV	0.13	0.5	0
PostAnglian	IV	3.42	0.01	0.3
	V	2.53	0.09	1
	VI	3.79	0.64	16.9
	XIII	0.48	0.01	2.1
	IX	1.09	0.1	9.2
	X	1.39	0	0
	XVI	1.79	0.09	5
Holocene	I	1.88	0.25	13.3
	II	6.16	2.34	38
	III	3.78	0.39	10.3
	XI	0.18	0	0
	XIII	0.48	0.01	2.1

	XIX	0.85	0.2	23.5
Unknown	XVII	0.34	0.01	0
	XVIII	0.07	0	0
Eroded	VII	13.5	0.01	0.7

APPENDIX I.

Zone description tables. Lea Valley zones I – XIX.

Zone descriptor		1		
Total area of zone	1.88	Area of zone lost to quarrying:		km ² %
				0.25 13.3
Bedrock geology (defined)		London Clay		
Bedrock geology (description)				
Superficial geology (defined)		Alluvium. Alluvium of Holocene date overlying gravels of Late Devensian date (Lea Valley Gravel)		
Superficial geology (description)		Floodplain fines (clays/silts/sands and organics) over gravels and sands. Area of deep basin like feature in gravel surface topography.		
Geomorphological situation		Valley floor, dominated by meandering channels, canalized channels and low slope angles (<1°)		
Age range of sediments		Late Pleistocene (?20,000)to recent		
Number of boreholes in zone		12		
Number of palaeoenvironmental sites in zone				
Number of recorded sites in zone				
Paleolithic		Mesolithic	Neolithic	
Bronze Age		Iron Age		
Roman		Saxon		
Post Medieval	12	Modern	3	2
Comments				
The earliest recorded sites in the zone date to the modern period and include a moated site. The majority of the HER entries relate to the industrial archaeology of the area; particularly the Royal Gunpowder works, Waltham Abbey and associated features (such as workers housing). Other features recorded include road bridges, gasworks and canal locks. Recorded modern features comprise pillboxes constructed in World War II.				
Key research questions				
Investigation strategies		Boreholes and test pits. Localised geophysics (electrical conductivity). Cone Penetration Tests.		

Zone descriptor		II			
Total area of zone	6.16	Area of zone lost to quarrying:		km ²	2.34
			%		38
Bedrock geology (defined)	London Clay, Lambeth Group				
Bedrock geology (description)					
Superficial geology (defined)	Alluvium. Alluvium of Holocene date overlying gravels of Late Devensian date (Lea Valley Gravel)				
Superficial geology (description)	Floodplain fines (clays/silts/sands and organics) over gravels and sands				
Geomorphological situation	Valley floor, dominated by meandering channels, canalized channels and low slope angles (<1°)				
Age range of sediments	Late Pleistocene (?20,000) to recent				
Number of boreholes in zone			43		
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
Paleolithic		Mesolithic	2	Neolithic	
Bronze Age		Iron Age	2	Prehistoric	1
Roman	6	Saxon	2	Medieval	
Post Medieval		Modern		Unknown	4
Comments	This zone includes an important Mesolithic site at RikoF's pit (a working floor and a large collection of unstratified material).				
The Saxon period is represented by an inhumation cemetery, excavated at Lapwoods Nursery, Nazing Mead in 1934 with subsequent rescue excavations in the 1970s. Estimates suggested a minimum population for the cemetery of c230. Roman artifacts were also recovered during the excavation.					
Post Medieval sites comprise bridges, locks, marker posts, wharves etc generally associated with the river/canal.					
Modern features comprise World War II defences.					
The sites of an unknown period are cropmarks and earthworks identified on the Essex side of the river.					
Key research questions					
Investigation strategies					

Zone descriptor		III		
Total area of zone	3.78	Area of zone lost to quarrying: <i>km²</i> %		0.39 10.3
Bedrock geology (defined)		London Clay		
Bedrock geology (description)				
Superficial geology (defined)		Alluvium. Alluvium of Holocene date overlying gravels of Late Devensian date (Lea Valley Gravel). Towards edge gravels of the Kempton Park Gravel (earlier part of Devensian) may exist beneath the alluvium		
Superficial geology (description)		Floodplain fines (clays/silts/sands and organics) over gravels and sands		
Geomorphological situation		Valley floor, dominated by meandering channels, canalized channels and low slope angles (<1°)		
Age range of sediments		Devensian (?90,000) to recent		
Number of boreholes in zone		33		
Number of palaeoenvironmental sites in zone				
Number of recorded sites in zone				
<i>Paleolithic</i>		<i>Mesolithic</i>		<i>Neolithic</i>
<i>Bronze Age</i>		<i>Iron Age</i>	1	<i>Prehistoric</i>
<i>Roman</i>	1	<i>Saxon</i>	1	<i>Medieval</i>
<i>Post Medieval</i>	4	<i>Modern</i>	2	<i>Unknown</i>
Comments		Prehistoric period: Aretefact collects, including one which "... would not be out of place in a Mesolithic context"		
		<p>The Saxon period is represented by an inhumation cemetery, excavated at Lapwoods Nursery, Nazing Mead in 1934 with subsequent rescue excavations in the 1970s. Estimates suggested a minimum population for the cemetery of c230. Roman/LIA artefacts were also recovered during the excavation.</p> <p>Two medieval moated sites, a causeway and wall associated with the abbey. Also various finds.</p> <p>Modern features comprise World War II pillboxes</p> <p>The sites of an unknown period are cropmarks and earthworks identified on the Essex side of the river.</p> <p>*** NB this zone includes the central area of Waltham Abbey. HER entries for this area have not been included in the site counts (c 140 in total)***</p>		
Key research questions				
Investigation strategies				

Zone descriptor	IV				
Total area of zone	3.42	Area of zone lost to quarrying:		<i>km²</i> %	0.01 0.3
Bedrock geology (defined)	Upper Chalk (Lewes Nodular Chalk Formation and Seaford Formation)				
Bedrock geology (description)					
Superficial geology (defined)	Kempton Park Gravel Formation. Much of area will consist of early to mid Devensian sand and silts over gravels but thin spreads of Holocene alluvium may also be present				
Superficial geology (description)	Thin veneer of fine clays-silts overlying sands and gravels				
Geomorphological situation	Valley edge, low lying topography (<3°)				
Age range of sediments	Devensian (?90,000) to recent				
Number of boreholes in zone	42				
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
<i>Paleolithic</i>		<i>Mesolithic</i>		<i>Neolithic</i>	
<i>Bronze Age</i>		<i>Iron Age</i>	1	<i>Prehistoric</i>	
<i>Roman</i>	2	<i>Saxon</i>		<i>Medieval</i>	2
<i>Post Medieval</i>	9	<i>Modern</i>		<i>Unknown</i>	3
Comments	Roman remains include a pottery kiln. Both mmedieval sites are moats Post medieval remains all associated with industry for example features associated with the railways and canals, a gasworks and a brickworks.				
Key research questions					
Investigation strategies					

Zone descriptor		V				
Total area of zone		2.53	Area of zone lost to quarrying:		<i>km²</i> %	0.09 <1
Bedrock geology (defined)		London Clay				
Bedrock geology (description)						
Superficial geology (defined)		Kempton Park Gravel Formation. Much of area will consist of early to mid Devensian sand and silts over gravels				
Superficial geology (description)		Thin veneer of fine clays-silts overlying sands and gravels				
Geomorphological situation		Valley edge, low lying topography (<3°)				
Age range of sediments		Early Devensian (c.90,000) to recent				
Number of boreholes in zone		41				
Number of palaeoenvironmental sites in zone						
Number of recorded sites in zone						
Paleolithic		Mesolithic		Neolithic	1	
Bronze Age		Iron Age		Prehistoric		
Roman	2	Saxon		Medieval		
Post Medieval	12	Modern		Unknown		
Comments		Neolithic flint axehead				
		Roman arefacts (coins and pottery)				
		Medieval sites comprise a memorial stone (?) and a moated site				
Key research questions						
Investigation strategies						

Zone descriptor	VI				
Total area of zone	3. 79	Area of zone lost to quarrying:		km ² %	0.64 16.9
Bedrock geology (defined)	London Clay				
Bedrock geology (description)					
Superficial geology (defined)	Enfield Silt Formation. Mid to Late Devensian silt probably overlying older gravels of the Kempton Park Gravel Formation				
Superficial geology (description)	Fine grained clays-silts.				
Geomorphological situation	Valley side, low lying topography (<3°)				
Age range of sediments	Early Devensian (c.90,000) to recent				
Number of boreholes in zone	54				
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
Paleolithic	1	Mesolithic	2	Neolithic	
Bronze Age	3	Iron Age	1	Prehistoric	
Roman		Saxon		Medieval	9
Post Medieval	5	Modern	1	Unknown	
Comments	Paleolithic (Levallois) artifact from Rikoff's pit				
	Two Mesolithic occupation sites (C14 dates of 9350 BP +/- 120 and 6895BP +/-75)				
	Bronze age entries refer to artifacts with possible uncertain provenance				
	Medieval sites include Rye House moated site and associated entries, Cheshunt nunnery, a leper hospital and a derr park.				
	Post medieval entries refer to the river and canal, a corn mill and a watercress bed				
Key research questions					
Investigation strategies					

Zone descriptor		VII				
Total area of zone	13.5	Area of zone lost to quarrying:			<i>km²</i> %	0.01 0.7
Bedrock geology (defined)	London Clay					
Bedrock geology (description)						
Superficial geology (defined)	Bedrock (various). Eroding bedrock					
Superficial geology (description)	Bedrock at surface					
Geomorphological situation	Valley side					
Age range of sediments	N/a concatenated and transported Palaeolithic to recent material					
Number of boreholes in zone	54					
Number of palaeoenvironmental sites in zone						
Number of recorded sites in zone						
<i>Paleolithic</i>		<i>Mesolithic</i>		<i>Neolithic</i>		
<i>Bronze Age</i>		<i>Iron Age</i>		<i>Prehistoric</i>		
<i>Roman</i>		<i>Saxon</i>		<i>Medieval</i>	5	
<i>Post Medieval</i>	9	<i>Modern</i>	13	<i>Unknown</i>	6	
Comments	Earliest period represented is the medieval, records include material from excavations at Grange Farm and Nazingbury moat.					
	Range of post-medieval records including artifacts recovered from dredging, chance finds, to the Waltham Abbey Gunpowder Factory.					
	Modern remains dominated by features from WWII including pillboxes and AntiAircraft Gun site and anti tank ditch.					
Key research questions						
Investigation strategies						

Zone descriptor		VIII			
Total area of zone	2.57	Area of zone lost to quarrying:		<i>km²</i> %	0.08 3.1
Bedrock geology (defined)	London Clay				
Bedrock geology (description)					
Superficial geology (defined)	Enfield Silt Formation. Silt possibly of multi-period formation overlying gravels of the Kempton Park Gravel Formation (downslope) and Taplow Gravel Formation (upslope)				
Superficial geology (description)	Fine grained clays-silts.				
Geomorphological situation	Valley side, low lying topography (<3°)				
Age range of sediments	Predominantly ? Late Middle Pleistocene (200,000) Devensian (20,000). Concatenated Middle Palaeolithic to modern				
Number of boreholes in zone					
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
<i>Paleolithic</i>	1	<i>Mesolithic</i>	1	<i>Neolithic</i>	1
<i>Bronze Age</i>	4	<i>Iron Age</i>		<i>Prehistoric</i>	2
<i>Roman</i>		<i>Saxon</i>		<i>Medieval</i>	2
<i>Post Medieval</i>	11	<i>Modern</i>	3	<i>Unknown</i>	
Comments	This zone includes the Turnford Brickyard. Collections from this yard include <ul style="list-style-type: none">• Paleolithic (Levallois) 'tortoise' core '... found in Taplow Brickearth'• EBA flints/pottery• EIA pottery Entries also refer to flint artifacts in the Warren Collection, including material of Mesolithic and Neolithic date.				
Key research questions					
Investigation strategies					

Zone descriptor	IX				
Total area of zone	1.09	Area of zone lost to quarrying:		km ² %	0.1 9.2
Bedrock geology (defined)	London Clay				
Bedrock geology (description)					
Superficial geology (defined)	Taplow Gravel Formation. MIS 6-4 cold stage gravels and possible warm interglacial silts				
Superficial geology (description)	Sands and gravels				
Geomorphological situation	Valley side				
Age range of sediments	Predominantly 200,000 – 50,000. Concatenated Middle Palaeolithic to recent.				
Number of boreholes in zone	3				
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
Paleolithic	1	Mesolithic		Neolithic	
Bronze Age		Iron Age	1	Prehistoric	
Roman	1	Saxon		Medieval	3
Post Medieval	1	Modern	2	Unknown	1
Comments	Paleolithic material a collection from Churchgate: includes several handaxes, a retouched flake, pointed handaxe etc. Medieval sites: a religious house at Wormley, an aqueduct and holy wells.				
Key research questions					
Investigation strategies					

Zone descriptor	X				
Total area of zone	1.39	Area of zone lost to quarrying:		km ² %	0 0
Bedrock geology (defined)	London Clay				
Bedrock geology (description)					
Superficial geology (defined)	Enfield Silt Formation. Silt possibly of multi-period formation overlying gravels of the Taplow Gravel Formation (upslope)				
Superficial geology (description)	Fine grained clays-silts.				
Geomorphological situation	Valley side				
Age range of sediments	Predominantly ? Late Middle Pleistocene (200,000) Devensian (20,000). Concatenated Middle Palaeolithic to modern				
Number of boreholes in zone	3				
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
Paleolithic	1	Mesolithic		Neolithic	3
Bronze Age	2	Iron Age		Prehistoric	
Roman		Saxon		Medieval	1
Post Medieval	1	Modern		Unknown	
Comments	Paleolithic material recovered from a brickworks. Includes Acheulian handaxe, butt end of a handaxe and 2 flakes.				
Key research questions					
Investigation strategies					

Zone descriptor	XI				
Total area of zone	0.18	Area of zone lost to quarrying:		<i>km²</i>	0
				%	0
Bedrock geology (defined)		London Clay			
Bedrock geology (description)					
Superficial geology (defined)		Alluvium. Probably late Devensian gravels beneath Holocene silts. Elements of colluvium probably also present			
Superficial geology (description)		Coarse gravel and sand overlain by fine grained clay-silts			
Geomorphological situation		Valley floors in tributary valleys			
Age range of sediments		Late Devensian and Holocene			
Number of boreholes in zone			0		
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
<i>Paleolithic</i>		<i>Mesolithic</i>		<i>Neolithic</i>	
<i>Bronze Age</i>		<i>Iron Age</i>		<i>Prehistoric</i>	
<i>Roman</i>		<i>Saxon</i>		<i>Medieval</i>	
<i>Post Medieval</i>	4	<i>Modern</i>		<i>Unknown</i>	1
Comments	Post-medieval remains include bridges, an aqueduct and a lock up.				
Key research questions					
Investigation strategies					

Zone descriptor		XII			
Total area of zone	1.81	Area of zone lost to quarrying:		km ²	0
				%	0
Bedrock geology (defined)		London Clay			
Bedrock geology (description)					
Superficial geology (defined)		Lowestoft Formation. Mixed packages of clay dominated till, coarse gravels intermittently present.			
Superficial geology (description)		Clays with poorly sorted gravels			
Geomorphological situation		Valley tops/plateau margins			
Age range of sediments		Anglian (c450,000). May contain elements of Lower Palaeolithic material. Lower Palaeolithic to modern material concatenated on surface			
Number of boreholes in zone		0			
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
Paleolithic		Mesolithic		Neolithic	
Bronze Age		Iron Age		Prehistoric	
Roman		Saxon		Medieval	1
Post Medieval		Modern		Unknown	
Comments	Single HER reference to earthworks and woodland banks which are probably medieval in date.				
Key research questions					
Investigation strategies					

Zone descriptor	XIII			
Total area of zone	0.48	Area of zone lost to quarrying: <i>km²</i> %		0.01 2.1
Bedrock geology (defined)	London Clay			
Bedrock geology (description)				
Superficial geology (defined)	Alluvium. Probably late Devensian gravels beneath Holocene silts. Elements of colluvium probably also present			
Superficial geology (description)	Coarse gravel and sand overlain by fine grained clay-silts			
Geomorphological situation	Valley floors in tributary valleys			
Age range of sediments	Late Devensian and Holocene			
Number of boreholes in zone	2			
Number of palaeoenvironmental sites in zone				
Number of recorded sites in zone				
<i>Paleolithic</i>		<i>Mesolithic</i>		<i>Neolithic</i>
<i>Bronze Age</i>		<i>Iron Age</i>		<i>Prehistoric</i>
<i>Roman</i>		<i>Saxon</i>		<i>Medieval</i>
<i>Post Medieval</i>		<i>Modern</i>		<i>Unknown</i>
Comments	2 medieval moated sites			
Key research questions				
Investigation strategies				

Zone descriptor	XIV				
Total area of zone	4.2	Area of zone lost to quarrying: <i>km²</i> %			0.05 1.2
Bedrock geology (defined)	London Clay				
Bedrock geology (description)					
Superficial geology (defined)	Kesgrave Formation. Stratified sands and gravels.				
Superficial geology (description)	Sands and gravels				
Geomorphological situation	Valley tops/plateaus				
Age range of sediments	Pre-Anglian Thames deposits. May contain reworked or in situ Lower Palaeolithic material. Concatenated Lower Palaeolithic to modern.				
Number of boreholes in zone	8				
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
<i>Paleolithic</i>		<i>Mesolithic</i>		<i>Neolithic</i>	1
<i>Bronze Age</i>		<i>Iron Age</i>	3	<i>Prehistoric</i>	2
<i>Roman</i>	7	<i>Saxon</i>		<i>Medieval</i>	9
<i>Post Medieval</i>	16	<i>Modern</i>	2	<i>Unknown</i>	3
Comments					
Key research questions					
Investigation strategies					

Zone descriptor		XV	
Total area of zone	0.13	Area of zone lost to quarrying: <i>km²</i> %	0.5ha 0
Bedrock geology (defined)		London Clay	
Bedrock geology (description)			
Superficial geology (defined)		Dollis Hill Gravel Formation.	
Superficial geology (description)		Sands and gravels with small proportion of Greensand chert. Locally beds of laminated silt and clay also present	
Geomorphological situation		Valley tops/plateaus	
Age range of sediments		Approximately 550,000 BP. Many contain reworked Lower Palaeolithic material. Concatenated Lower Palaeolithic to modern material on surface	
Number of boreholes in zone		0	
Number of palaeoenvironmental sites in zone			
Number of recorded sites in zone			
<i>Paleolithic</i>		<i>Mesolithic</i>	<i>Neolithic</i>
<i>Bronze Age</i>		<i>Iron Age</i>	<i>Prehistoric</i>
<i>Roman</i>		<i>Saxon</i>	<i>Medieval</i>
<i>Post Medieval</i>		<i>Modern</i>	<i>Unknown</i>
Comments			
Key research questions			
Investigation strategies			

Zone descriptor	XVI					
Total area of zone	1.79	Area of zone lost to quarrying:			<i>km²</i> %	0.09 5
Bedrock geology (defined)		London Clay				
Bedrock geology (description)						
Superficial geology (defined)		Taplow Gravel Formation. MIS 6-4 cold stage gravels and possible warm interglacial silts				
Superficial geology (description)		Sands and gravels				
Geomorphological situation		Valley side				
Age range of sediments		Predominantly 200,000 – 50,000. Concatenated Middle Palaeolithic to recent.				
Number of boreholes in zone		9				
Number of palaeoenvironmental sites in zone						
Number of recorded sites in zone						
<i>Paleolithic</i>		<i>Mesolithic</i>		<i>Neolithic</i>		
<i>Bronze Age</i>		<i>Iron Age</i>		<i>Prehistoric</i>		
<i>Roman</i>	2	<i>Saxon</i>	1	<i>Medieval</i>	1	
<i>Post Medieval</i>	13	<i>Modern</i>	2	<i>Unknown</i>		
Comments	Roman and Saxon references are to collections of finds					
Key research questions						
Investigation strategies						

Zone descriptor	XVII				
Total area of zone	0.34	Area of zone lost to quarrying:		km ² %	<0.01 0
Bedrock geology (defined)		London Clay			
Bedrock geology (description)					
Superficial geology (defined)		Unknown. Possible fluvial sands and gravels			
Superficial geology (description)		Sand and gravel			
Geomorphological situation		Valley side			
Age range of sediments					
Number of boreholes in zone		1			
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
Palaeolithic		Mesolithic		Neolithic	
Bronze Age		Iron Age		Roman	
Saxon		Medieval		Post-Medieval	
Comments					
Key research questions					
Investigation strategies					

Zone descriptor	XVIII				
Total area of zone	0.07	Area of zone lost to quarrying:		km ²	0
				%	0
Bedrock geology (defined)		London Clay			
Bedrock geology (description)					
Superficial geology (defined)		Unknown. Possible fluvial sands and gravels			
Superficial geology (description)		Sand and gravel			
Geomorphological situation		Upper Valley side			
Age range of sediments					
Number of boreholes in zone			0		
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
Paleolithic		Mesolithic		Neolithic	
Bronze Age		Iron Age		Prehistoric	
Roman		Saxon		Medieval	
Post Medieval		Modern		Unknown	
Comments					
Key research questions					
Investigation strategies					

Zone descriptor		XIX		
Total area of zone		Area of zone lost to quarrying: <i>km²</i> %		
Bedrock geology (defined)				
Bedrock geology (description)				
Superficial geology (defined)		Alluvium. Alluvium of Holocene date overlying gravels of Late Devensian date (Lea Valley Gravel). Towards edge gravels of the Kempton Park Gravel (earlier part of Devensian) may exist beneath the alluvium		
Superficial geology (description)		Floodplain fines (clays/silts/sands and organics) over gravels and sands		
Geomorphological situation		Valley floor, dominated by meandering channels, canalized channels and low slope angles (<1°). River confluence zone		
Age range of sediments				
Number of boreholes in zone				
Number of palaeoenvironmental sites in zone				
Number of recorded sites in zone				
<i>Palaeolithic</i>		<i>Mesolithic</i>		<i>Neolithic</i>
<i>Bronze Age</i>		<i>Iron Age</i>		<i>Roman</i>
<i>Saxon</i>		<i>Medieval</i>		<i>Post-Medieval</i>
Comments				
Key research questions				
Investigation strategies				

Zone descriptor		XIX			
Total area of zone		0.85	Area of zone lost to quarrying: <i>km²</i> %		0.20 23.5
Bedrock geology (defined)		Upper Chalk (Lewes Nodular Chalk Formation and Seaford Formation); Lambeth Group			
Bedrock geology (description)					
Superficial geology (defined)		Alluvium. Alluvium of Holocene date overlying gravels of Late Devensian date (Lea Valley Gravel). Towards edge gravels of the Kempton Park Gravel (earlier part of Devensian) may exist beneath the alluvium			
Superficial geology (description)		Floodplain fines (clays/silts/sands and organics) over gravels and sands			
Geomorphological situation		Valley floor, dominated by meandering channels, canalized channels and low slope angles (<1°). River confluence zones			
Age range of sediments					
Number of boreholes in zone		41			
Number of palaeoenvironmental sites in zone					
Number of recorded sites in zone					
<i>Paleolithic</i>		<i>Mesolithic</i>		<i>Neolithic</i>	
<i>Bronze Age</i>		<i>Iron Age</i>		<i>Prehistoric</i>	
<i>Roman</i>		<i>Saxon</i>		<i>Medieval</i>	
<i>Post Medieval</i>	3	<i>Modern</i>	2	<i>Unknown</i>	1
Comments		Post-medieval/modern entries relate to the canal/river (and associated features) the railway and road infrastructure.			
Key research questions					
Investigation strategies					

Table 4. Distribution of geoaarchaeological zones by geomorphological position in Lea

Valley bottom	Valley margins	Valley tops
I/II, III, IV, V, VI, VII, VIII, IX, X, XII, XIII, XIV, XV, XVI, XVII, XVIII, XIX	IV, V, VI, VII, VIII, IX, X, XVI, XVII, XVIII	XII, XIV, XV

Table 5. Distribution of geoaarchaeological zones by phase.

Pre-Anglian	Post-Anglian terraces	Holocene valley bottom	Unknown	Eroded bedrock valley side
XII, XIV, XV	IV, V, VI, VIII, IX, X, XVI	I, II, III, XI, XIII, XIX	XVII, XVIII	VII

