

Oxford Archaeology

"London Gateway: Archaeological monitoring of geotechnical investigations at Shell Haven (Contract 11501), Stanford-le-Hope, Essex, June 2008"

Watching Brief Report

1. Summary

A geoarchaeological watching brief on geotechnical investigations at Shell Haven, Stanford-le-Hope, Essex, was carried out from May 27th to June 13th 2008 on the Swift Building Site and in other locations.

Watching briefs maintained at:

Swift Development Site	May 27 th to 29 th 2008	borehole (BH02)
Swift Development Site	May 27 th to June 13 th 2008	32 trial pits
Northern Triangle East - Coryton	30 th May	4 trial pits (Ponds 1 - 4)

A geophysical team (ground conductivity) was working for OA at Shell Haven during the same period and was supported when geotechnical investigations rested (part off the digital photographic record refers to their work). On the 3rd June Shell Haven Site A at visited fore about 1 h.

2. Method

Geotechnical trial pits were mechanically excavated by a JCB. The dimensions of the pits were 0.6 to 0.9m width and 3.00 to 4.0m length. Designated depths were 1.5, 2.0, 2.5 and 3.0mBGL. Actual depths reaches 0.8 to 3.3m, as some excavations had to be aborted due to ground contamination, high water tables or power cables.

In preparations of the excavation of a trail pits on the Swift Development Site an Ecologist would check the excavation area and the rout to it access for amphibians.

At the Northern Triangle the unexploded Ordnance (UXO) Expert checked the ground before excavation. On the Swift Development Site electromagnetic detection was not feasible, as metal scape or brick debris would have constantly generated falls signals. Therefore an Unexploded Ordnance (UXO) Expert was on watching brief. Several representatives of FUGRO, DP World and experts of the ecological consultants of DP World and SHELL were present most of the time.

The topsoil was stripped first. Attention was paid to possible immediate finds of archaeology, UXO and amphibians by the relevant personal present. The trail pit was brought down in several stages to about 0.5 and 1.0mBGL depth. The pit would be entered for investigation and measurements down to a depth of 1.2mBGL if appropriate. Frequently, on section of the pit would be cleaned with a spade by the Geoarchaeologist.

Below the depth of 1.2mBGL it was no longer save to access the pits. Sections and the bottom of the trial pits were observed from the ground level during excavation. Investigation of the sediment was carried out on the spoil discarded of the JCB bucket. Sediment chunks from the JCB bucket were cleaned with the spade, to identify fine layers, thin organic bands, mottling blackish flecks or plant detritus if present.

Particle size was determined with the finger field test. Colours were determined by reference to the MUNSELL SOIL COLOUR CHART. The colour was also described conventionally.

Pits were refilled immediately after investigation.

3. Results from ground investigations at Swift Development Site

3.1 Shell and Auger Drilling Swift Development Site

Shell and Auger Drilling on BHO2 and BHO1

Cable Percussion Bore Hole Initially two bore holes of 40.0mBGL depth were scheduled Borehole (OG2008-BH2) was logged down to the Bases of the Alluvium at 16.7mBGL according to the accessible bulk and Tube samples during the watching brief. The drilling of borehole (OG2008-BH01) was not monitored as the exploratory pits were excavated at the same time. Six more boreholes were brought down at a later stage.

- 1.5mBGL brown clayey silt / silty clay
- 2.5mBGL grey silty clay, small blackish patches
- 6.3mBGL dark greyish brown / dark grey silty clay
- 6.5mBGL **peat** at 6.3 to 6.5mBGL
- 7.8mBGL dark grey silty clay, fine blackish flecks
- 8.0mBGL layer of black organic rich silt
- 9.0mBGL dark grey silty clay
- 15.5mBGL sandy silty clay / silty or clayey fine sand
- 16.0mBGL clayey sand, shell fragments and fine red fragment (organic?)
- 16.7mBGL yellowish brown silty clay
- below 16.7 sandy gravel, moderately sorted, green sands at a lower level

3.2 Initial Trial Pits on Swift Development Site

Location of initial trial pits on Swift Development Site

Initially 16 trial pits were envisaged in a 200 by 200m wide square 50m grid just south of the A1014 and about 200m NE of the Shell Haven Bitumen Plant. Only 6 trial pits were excavated: GO2008-TP1, -TP2 -TP4, -TP7, -TP10 and -TP13. Designated standard depth was 1.5mBGL. Actual depths varied from 0.8 to 2.0m. Excavations were completed by the 4th June.

The principle stratigraphy is represented by trial pit GO2008-TP2

- 0.4mBGL dark greyish clayey silt, occasional fine fragments of charcoal, grass roots
- 1.1mBGL light brown with fine orange mottles
- 1.5mBGL grey brown silty clay
- 1.80mBGL (Base) bluish grey clay with fine blackish and reddish plant remains and roots channel concretions

In the majority of the 1.50mBGL deep pits only the top part of the sequence with the brown mottled alluvium is represented. Pit GO2008-TP13 also shows a dark bluish grey alluvium at 1.1 to 1.5mBGL with small blackish inclusions, fibrous plant remains and possibly eroded peat. In Trial Pit GO2008-TP7 a dark grey brown layer at 0.30 to 0.44mBGL seems to belong to an earlier land surface buried under a modern top soil. The water table was not reached.

Made ground and contamination

The 4 most northern trial pits, GO2008-TP1, -TP2 -TP4 and -TP7 exposed natural alluvium from base to top with none or little modern inclusions. Made ground was 0.3m deep and contaminated with bitumen occasional bits at pit GO2008-TP13. The made ground of a cable trench was excavated down to 0.8mBGL depth pit GO2008-TP10, when the excavation had to be stopped, due to heavy contamination with petrol products and a power cable in the ground.

3.3 Trial Pits along the Infrastructure Channel on the Swift Development Site

Location of the trail pits

26 trail pits from 0.8 to 3.00m depth were excavated in connection with a drainage channel ground investigation on the Swift Building Site. Pits were excavated in 250m intervals along an stepped line East, South and South-West of the initial trail pit area.

Pits were numbered SW2008/TP01 through SW2008/TP26. The numbering of the pits begins in the North and the runs south and later west.

Directions of trial pit alignments

SW2008/TP01 to SW2008/TP11	North to South
SW2008/TP11 to SW2008/TP18	East to West
SW2008/TP18 to SW2008/TP20	North to South
SW2008/TP20 to SW2008/TP26	East to West

Made Ground

Modern man made surface deposits of demolition rubble, sandy gravels and top soil mixed with fragments of bricks and concrete and a slag called "Klinker" occurred in all trial pits. The top soil is regularly developed from made ground with the exception of some rare cases, where the old surface seems to be just contaminated with some demolition rubble. Depths of made ground vary from 0.3 to 2.3m. At the location of pits SW2008/06 and SW2008/07 the ground was sealed with a floor of massive 0.25 thick concrete slabs.

Depths of made ground

shallow	0.3 to 0.4mBGL depth	
medium deep	0.7 to 1.1mBGL depth	
deep	1.6 to 2.3mBGL depth	SW2008/TP13 /TP14 /TP18A and /TP25

Contamination of made ground

Obvious contamination of mad ground with petrol products was met at trail pit SW2008/TP06.

Alluvial Sequence

Below made ground a silty clay alluvium occurred from top to base of the excavations. Two main parts were observed: An upper part from about 0.3 to 2.10mBGL with varying sequences of brown, light brown, greyish brown and light grey silt - clay alluvial deposits with frequent mottling and a lower part with bluish grey, dark grey or dark greenish grey silt - clay deposit frequently with fine evenly spread blackish flecks and moderately frequent with small plant remains, possibly roots. Occasionally horizons of dense blackish flecks are observed in a pit (SW2008/TP16A). Dark greenish grey alluvial deposits with fine blackish flecks and plant remains occasionally occur at about 3.0m. A sandy silt of a dark greyish brown colour was observed at 3.0m in SW2008/TP15. The alluvial sequence from trial pit SW2008/TP24 is rather typical:

- 0.2 topsoil developed in made ground, occasional brick fragment
- 0.4 very dark brown mottled clayey silt, buried soil or made ground
- 1.1 brown mottled clayey silt
- 1.7 light brown mottled silty clay
- 2.3 bluish grey silty clay, fine blackish flecks
- 3.0 dark grey silty clay, fine blackish flecks

A different alluvial stratigraphy was met along the North–South leg of the Infrastructure Channel in the trail pits SW2008/TP01 to SW2008/TP8, and also in the close by pits SW2008/TP12 and SW2008/TP16 on the East-South transect. A dark grey or dark brownish grey alluvium is found at the top position of the alluvial sequence at 0.35 to 1.60mBGL. A representative sequence is pit SW2008/TP02:

- 0.20 top soil from made ground, small bitumen and brick fragments
- 0.35 made ground, slag, gravel size, brick fragments
- 0.90 dark brownish grey layered alluvium, weak mottling, plentiful fine blackish flecks
- 1.70 light bluish grey silty clay, strong mottles

Peaty Deposits

Thin organic rich deposits that seem to contain a weak peat layer or bits of eroded peat were met in six pits mainly from the same area. SW2008/3 is a pit further to the north. The alluvial sequences in the pit of this area show an upper dark grey silty clay deposit SW2008/3 on top of the general sequence. The organic rich spongy layer from SW2008/3 is interspaced such a dark grey alluvium.

Peaty Deposits in Trail Pits on the Swift Development Site

SW2008/1	0.70 -1.50m	Small blackish lumps, possibly eroded peat in dark grey clayey silt
SW2008/3	0.45 – 0.50m	Very dark brown organic rich spongy silt clay
SW2008/12	2.10 – 2.25m	Dark greenish clay with dark brown peaty organic residue
SW2008/14	1.90 – 2.00m	Dark brown clayey silt, organic rich, spongy, peaty
SW2008/15	Approx. 1.60m	Thin organic rich band with small badly rounded pebbles
SW2008/17	3.00 – 3.30	Dark greenish grey alluvium, fine blackish flecks, plant remains / reeds / peat
SW2008/18	2.40 and 2.80	Several thin brown bands of organic rich silt

Archaeological Finds (Flint) from SW2008/TP17

Archaeological finds were met at SW2008/TP17 several struck flint objects were collected from the surface at SW2008/TP17 (Context 6, bulk sample 1) and from the spoil of the dark brownish grey clayey silt.

The stratigraphy of SW2008/TP17 is:

context 6	0.1 topsoil developed in clayey silty gravel (made ground)
context 5	0.4 made ground, dark brown silty clay with many brick fragments
context 4	1.8 brown mottled silty clay, small blackish patches at approx. 1.40m
context 3	3.0 dark brownish grey clayey silt, blackish patches, plant remains (roots)
context 2	3.3 dark greenish brown clayey silt, blackish plant remains (reeds/peat)

Discussion

Not worked flints and struck flint occurred at the surface of trail pit SW2008/TP17. The attracted special attention to the soil brought up in the JCB bucket. Several pieces of not worked flint were picked from the alluvial sediments. A flint artefact was picked from a bucked load of spoil of dark brownish grey clayey silt (context 3) and cleaned from sediment attached.

Flint artefacts from the surface layer (context 6) are most likely dislocated and were brought to the location with the modern deposit of the made ground.

The flint artefact allocated to context 3 was collected from the soil heap during excavation. Potentially, it could have been collected from the surface context by the JCB bucket and mixed into the spoil. Due to the early occurrence of flint attention was focus on further possible flint finds. The allocation of the artefact to a depth of about 2.0BGLm was effected without doubt on site, as flint was regularly coming up with the spoil.

The stratigraphy reveals no paleo-surface that the artefact could be related to. The low energy alluvial sediment of silt and clay does not naturally contain angular, pebble size flint objects. The flint would have to be dropped *nolens volens* into the sediment.

A final conclusion on the origin of the artefact and its relation to the alluvial sequence is not possible, due to the limited observation conditions during trial pitting. There were the usual limitations on the precision of observations concerning the lower stratigraphy of the pit, measurements of depths and allocation of spoil to different deposits within the stratigraphy.

4. Results from the Northern Triangle East – Coryton

Investigation Area

The area of investigation is a wide level grass land area with a few partially silted up former fleets and four bomb craters. To the North, the level ground edges against the gravel terrace. The area seems to have been included in an old sea defence. Ridge and furrow patterns are emphasized by the grass vegetation west of the area with the trowel pits.

4 test pits were excavated on 30th May in the North Triangle at the locations of the prospective ponds 1 to 4, numbered P1, P2, P3, P4 respectively. Standard depth was 3.00 meters. The UXO-Expert checked for the ground unexploded ordnance before excavation progressed.

The general Sequence is represented by Pit 2 (Pond 2):

- 0.25mBGL well developed topsoil (A) horizon, rich in organic mater, plentiful grass roots.
- 1.0mBGL light brown mottled firm clayey silt
- 1.9mBGL light greyish brown silty clay
- 3.0mBGL dark grey silt some times sandy laminated clay, small blackish plant remains towards the base and root channel concretions

No modern deposits did occur. The top soil horizon (A – horizon) is well developed and seems to be an old plough soil. The Groundwater table has not been reached at 3.0mBGL.

Archaeological feature (Context 1) from pit3 / North Triangle

In trial pit P3 (Pond 3) a 0.05m thick spread of burnt clay and charcoal was was observed at 0.85mBGLIt was 0.6m wide. The full longitudinal extent could not be establish as the feature extended into both side section. Only in southern section the feature could be observed. The shape could have been oval. It could be a hearth. In the south section weak traces of reddish clay were observed. An estimated 50% of the the deposit was sampled (environmental sample no 1) and brought to the Oxford Office. The sample has not been processed jet, as more samples are expected to be obtained at Shell Haven soon. The stratigraphy of the alluvium in pit 3 is given below:

- 0.5mBGL dark brown organic rich silt plentiful small roots
- 0.85 light brown mottled firm silty clay
- 0.9mBGL **context 1, hearth**, charcoal and burnt clay
- 1.50mBGL light brown mottled silty clay
- 3.0mBGL dark grey laminated fine silty sand

Discussion

No finds turned up with the hearth. Despite the small amount of time available, general conditions for the investigation were good, with the exception of a rather confined space in the only 0.6m wide trench.

The feature was deposited on light brown alluvial clay. no traces of an old surface occur. The location varies from other pits in that it seem situated on a sort of “island” made of dark grey silty sand at 1.5mBGL.

5 Note on Site A

During excavation of 9 geotechnical trail pits on SITE A, A. STEPIEN (FUGRO) observed charcoal and burnt clay similar to context # 1 we observed in pit 3 in the North Triangle. The water table was not reached in the southern pits. In the northern pits, water table rises towards the north. Amos to the north the stratigraphy is getting more changeable, with gravels turning up. The pits had depths of 3 to 4m. The locations of the pits and the observations made are given below.

Trail Pit	Observation	NG Easting	NG Northing
Pit 1	Below A horizon in “made ground” spread of charcoal and small (1cm) soft reddish lumps.	E 570255	N 181153

Pit 9	1.2m BGL around land drain in one side of pit small (1cm) soft reddish lumps	E 569468	N 181071
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On the 3rd June 2008 A. STEPIEN showed C. HEISTERMANN the locality and the location of Pit 1. During a short walk over part of the area planted with corn at the time, several artefacts were collected from the surface: A possible but of a neolithic axe, a flint scraper, a burnt flint flack and a rim sherd. Finds were listed under Corsh08, Context 7, Site A and handed over to finds department at the Oxford Office.

6. Discussion

6.1 Discussion of Shell and Auger Drilling Results

Borehole BH02 is situated right in the centre of the investigation area. The main peat occurred at 6.30mBGL approx. 20 cm thick. The base of the Holocene alluvium was met at 16.7mBGL. This corresponds well with the previous results in the OA report LG4 from October 2001. Only bulk samples and samples in small Tubes were logged, as cores were reserved for later inspection.

6.2 Discussion on Trial Pitting Results

Observation conditions and limitations

All pits were excavated for geotechnical purposes but were made available to geoarchaeological recording. Geoarchaeological investigation was sometimes rushed by the need to keep up with the geotechnical team.

Observation condition were good as long as the trail pits were shallow and could still be entered. Although the JCB bucket tended to smear and obscurer the sections, the spade cleaned upper parts of the sections retained most of there distinctness.

Below 1.2mBGL observations direct became more difficult, due to a number of factors:

- limited access to the sides of the pit
- reduced field of vision on the sections of the narrow pits
- bucket smears on the sections

Limitations also occurred with continues observation of the spoil as an indirect mewns of observations of the stratigraphy.

- smeared sediment chunks from the bucket spoil
- spoil of particular interest rapidly buried beneath next bucket full
- keeping up with the provenance of the spoil
- correct estimates on top and base position of chunks of spoil

It proved very useful to clean the sides of sediment chunks from the JCBs bucket with the spade. With the sides cleaned, fine layers, inclusions and relevant details like mottling, thin organic bands, blackish flecks or plant detritus could be detected if present. With the excavation in progress, logging the sediment sequence and keeping up with the origin of the spoil and cleaning and investigating it has to be done simultaneously.

As a consequence of those limitations, the precision concerning the position of of sediment boundaries and the measurements of depths BGL is reduced. Major stratigraphical changes in the alluvial sediment body indicated by changes in colour, texture, firmness and moisture will still observed. Details on the sediment build up might not always be

observed. The stratigraphical position of details obtained from spoil heap observations often needs to be estimated within a margin of about 0.3m.

Results

The maximum depth of the trial pits was slightly more than 3.0mBGL. All fully excavated pits that penetrated the made ground met an alluvial estuarine sediment sequence. Basal gravels were not reached. In the Shell and Auger Drilling at Borehole BH02 in the centre of the investigation area, the base of the Holocene alluvium was met at 16.7mBGL. Also the groundwater table was not reached in any trial pit. Occasional flooding of pits was due to surface water or leaking pipes.

Traces of layers containing organic material were met between 0.45 and 3.30mBGL. The contained peat, root remains (water plants?), organic rich layered bands and possibly eroded peat. This is consistent with results in the LG4 report. A peat at 0.45 in trail pit SW2008/TP03 is consistent with occasional observations of peat just below made ground (LG4 2001).

A new result from the 2008 is the presence of a weak peat body at about 2.0mBGL in several pits.

Only the upper stratigraphy of the alluvium was reached by the trial pits.

Water table

It seems that the water table has been lower considerably in the past through including the once tidal flood plane in the sea defence and by draining the area. The height of the former water table would correspond with the level of the boundary between the brown and the dark blueish clay. The frequent presence of blackish decayed plant remains in the dark blueish clay reflects better preservation for organic matter under once waterlogged conditions. The mottling in the upper, brown sequences indicates variable periodically rising and falling water tables in the past, probably before the lowering of the water table occurred.

Archaeology

Archaeological evidence was encountered in trial pit SW2008/17 but their origin could be due to modern dislocation with a made ground deposit and is uncertain without further investigation.

Reference:

LG4 2001: Assessment of Effects. Cultural Heritage in Respect to the prospected development of London Gateway Commercial Development. Jon Chandler et. al Appendix F: Deposit Model

6. Appendix

List of Documents Swift Building Area:

Photographic Record listing 235 digital photographs

Sediment Logs for 32 geotechnical trial pits in Swift Building Area

Bore Hole Log for Shell and Auger bore hole BH02

Context sheets for contexts 1-7

Ground Investigation and Fieldwork Schedule (DP World04/06/2008)

map of pit locations for infrastructure 1:5000

map and coordinates initial trail pits and bore holes

Documentation referring entirely to North Triangle:

List of Coordinates and Elevations

Site map of designed ponds 1:1500 (DP World)

Sediment Logs for 4 geotechnical trail pits in North Triangle

Environmental sample register

Context sheet for context 1

Documents on Area of Site A:

Context 7 CORSH08 (Bulk find 3)

Geophysical Team

some of the photo documentation refers to the field work of the geophysical team

Date still to be retrieved from the principal contractor

National Grid Coordinates and ground level elevations adjusted to the actual positions of the geotechnical trail pits for the drainage channel in the Swift Building area are still to be obtained through the contractor (DP WORLD).

Elevations for bore holes BH01 and BH02

Ground level elevations for the geotechnical trail pits originally designed for archaeological purposes (TP 1, 2, 4, 7, 10, 13) in the Swift Building area are still to be obtained through the contractor (DP WORLD). National Grid Coordinates have been put down in the field, but might be obtained all the same.

Geotechnical logs, coordinates and elevations for trial pits (9 pits) on Site A.