

Holme Sluice Fish Pass, Colwick, Nottingham.

Archaeological Monitoring and Recording (Watching Brief) of Ground Investigations and Boreholes



Prepared for Royal HaskoningDHV / Environment Agency

T. Keyworth

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Trent & Peak Archaeology ©
Unit 1, Holly Lane
Chilwell
Nottingham
NG9 4AB
0115 8967400 (Tel.)
0115 925 9464 (Fax.)
tparchaeology.co.uk
trentpeak@yorkat.co.uk



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Summary

Fourteen machine-dug trial pits were excavated between 23/05/17 and 26/05/17 as part of the Ground Investigations to inform the design and construction of the proposed Holme Sluice Fish Pass at Colwick, Nottingham. Five boreholes were also sunk but unobserved. Consequently, the logs and samples taken during the sinking of the boreholes were consulted and interpreted.

No archaeological deposits or horizons were encountered during the continuous monitoring of the Ground Investigations. A sequence of deposits was identified from the ground surface through to the mudstone bedrock. Extensive made up ground, some of which was contaminated with hydrocarbons, consisting of mainly reworked alluvial material and redeposited superficial sands and gravels, below the topsoil and subsoil lies directly on top of 'natural' alluvial deposits.

Based on previous archaeological investigations and monitoring conducted in the area it seems likely that the extensive made ground could in fact mask and protect archaeological remains which may be present within the 'natural' alluvial deposits and within the superficial sands and gravels.

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1 INTRODUCTION

1.1 Background

- 1.1.1 This document on the archaeological monitoring of Ground Investigations, in the form of machine-dug trial pits and boreholes, has been prepared for Royal HaskoningDHV who are acting on behalf of their clients, the Environment Agency. This comprises a report detailing the Archaeological Monitoring and Recording (Watching Brief) undertaken during Ground Investigations carried out at Holme Sluice, Colwick in advance of the proposed Holme Sluice Fish Pass.
- 1.1.2 The site location (SK 61327 39394) is shown in Figure 1 and specific areas for Ground Investigation monitoring are depicted on Figure 2.
- 1.1.3 A Written Scheme of Investigation (WSI) (Keyworth and Stein 2017) outlines the entirety of the Archaeological Monitoring and Recording of Ground Investigations and Boreholes. This report will cover the machine-dug trial pits and boreholes as part of the Ground Investigations. The existing WSI should be consulted for the historical and archaeological background, current land use, relevant policy and guidance, project design, wider project aims and objectives, methodology and so on. In addition, there is a detailed Desk Based Assessment (DBA) (Mounce 2017) produced by Royal HaskoningDHV which may be consulted should further information be required.
- 1.1.4 **Location and topography:** The Proposed Development Area (PDA) lies at approximately 23m AOD and is relatively flat occupying a narrow strip of land c.100m wide separating quarry-filled artificial lakes located within Colwick Country Park to the north and the current course of the River Trent to the south.
- 1.1.5 **Geology:** The bedrock geology is mapped as Tarporley Siltstone Formation of the Mercia Mudstone Group, comprising siltstone, mudstone and sandstone, which formed approximately 237 to 250 million years ago in the Triassic Period. Pre-Holocene sand and gravel overlies the solid bedrock, representing periods of high energy outwash during glacial drainage. Holocene superficial deposits of alluvium, comprising clay, silt, sand, gravel, and peat are recorded on top of the Pleistocene sand and gravel (BGS, 2017).
- 1.1.6 **Current land use:** Currently the PDA is occupied by the Environment Agency compound for access to Holme Sluice and related grassland areas associated with Colwick Country Park.

1.2 Aims and purposes

1.2.1 The aims of the monitoring of Ground Investigations were to try and obtain archaeological/geoarchaeological evidence for the study area/site by undertaking continuous monitoring of the machine-dug trial pits and, where possible, boreholes.

1.2.2 The objectives were:

- to identify the presence of any remains of archaeological or geoarchaeological significance to be affected by any intrusive aspects of the scheme;
- to achieve an appropriate level of preservation by record;
- to sample identified remains for palaeoenvironmental assessment or dating.

1.2.3 Any features of geoarchaeological interest were, when possible, recorded and when there was the potential for appropriate palaeoenvironmental remains, an appropriate level of sampling was undertaken.

1.3 Methodology

1.3.1 A detailed methodology has already been produced and can be consulted in the existing WSI (Keyworth and Stein 2017) and therefore this relates to the specific undertaking of the continuous monitoring of Ground Investigations undertaken between 23/05/17 and 26/05/17. Interpretations of the results of the boreholes and test pits discussed here are those of Trent & Peak Archaeology taken from a geoarchaeological viewpoint, and may differ slightly from the interpretations given by the Royal Haskoning geotechnologists.

Machine-dug trial pits

1.3.2 Continuous monitoring was undertaken during the excavation of fourteen machine-dug trial pits. A 2.5 tonne excavator using a 0.45m toothless ditching bucket excavated trial holes to a depth of 1.5m or the maximum extent of the machine arm (~2.3-2.5m).

1.3.3 Locations were identified and CAT scanned for buried services. Following clearance, turf and topsoil were removed and stacked separately on a plastic tarpaulin. A further CAT scan was undertaken until otherwise unsafe every ~0.20m spit. Additional sediments and soils were stacked on separate tarpaulin. The desired depth was attained, the holes were recorded, photographed, sampled when appropriate, and backfilled in the order in which the material had been extracted. The topsoil and turf was replaced and flattened using the excavator.

Boreholes

1.3.4 Continuous monitoring was not undertaken of the shell and auger drilling rigs due to casing being utilised for the entirety of the boreholes; making any monitoring impossible. Two of the five boreholes were observed (BH05 and BH01) but nothing was recorded directly. The driller's and engineering geologist's logs were consulted as well as borehole samples, which were viewed and recorded when the samples are extruded from their casings. The Geocon borehole logs that were used were recorded in advance of formal submission, and this should be taken into account.

1.3.5 Samples were monitored during their extruding from the casing at the laboratory on 23/06/17.

2 RESULTS

2.1 Machine-Dug Test-Pits

2.1.1 A total of fourteen machine-dug test pits were excavated, recorded and subsequently backfilled. The locations of the Ground Investigations can be seen in Figure 2. The locations, heights and total depths of the test pits are summarised in the table below:

Trial Pit	Easting	Northing	Height (AOD)	Total Depth (m)
TP01	461240	339361	22.94	1.50
TP02	461265	339388	22.83	2.20
TP03	461275	339372	22.9	2.20
TP04	461297	339382	22.95	2.20
TP05	461304	339368	22.92	2.20
TP06	461287	339403	22.54	2.00
TP07	461308	339421	22.04	2.10
TP08	461341	339432	21.7	1.55
TP09	461365	339423	21.77	1.55
TP10	461382	339421	21.91	2.00
TP11	461342	339451	21.25	1.50
TP12	461374	339450	21.72	2.30
TP13	461405	339447	21.47	1.50
TP14	461425	339439	21.25	2.50

Table 1: Locations, heights and total depths of machine-dug test pits.

2.1.2 Machine-dug test pits were excavated to a minimum depth of 1.5m and beyond this where deemed appropriate and safe. The maximum depths reached were between 2.2-2.3m due to restrictions imposed by the length of the machine arm/bucket and safety concerns.

2.1.3 **TP01:** TP01 was located to the western extent of the site on the south side of southwest-northeast aligned River Road / Swan Meadow and attained a total depth of 1.5m. From the ground surface at 0.00m to 0.20m was dark brown sandy silt with grass roots and rootlets, interpreted as topsoil. Between 0.20m and 0.50m there was a mid yellowish-brown sandy (medium-coarse) silt with continuation of the roots from above, interpreted as subsoil. Below this from 0.50m to 0.90m there was dark brownish-grey gravelly clay with inclusions of medium-coarse sand and round / sub-rounded stones and cobbles of sandstone and mudstone. In addition to this there were fragments of brick. It is likely this is made ground consisting of redeposited sands and gravels mixed with both topsoils and subsoils. From 0.80m there was evidence of hydrocarbon contamination which also leached downwards into the sands and gravel below. Between 0.90m and the trial pits end at 1.50m was a mid yellowish-orange silty sand and gravel with clay lenses. The gravel was rounded / sub-rounded and the sand was medium to coarse. This became darker with depth past 1.30m. This has been interpreted as the superficial sands and gravels.

2.1.4 **TP02:** TP02 was located ~37m northeast of TP02 on the northern side of River Road / Swan Meadow and attained a total depth of 2.20m. From the ground surface at 0.00m to 0.20m was dark brown slightly sandy clayey silt with grass roots and rootlets, interpreted as topsoil. Between 0.20m and 1.50m there was mid yellowish-brown clayey sandy (medium-coarse) gravel, with a continuation of the roots from above, interpreted as subsoil and likely made ground. From 1.50m to 2.00m there was loose light-mid brownish grey sandy (medium-coarse) gravel (sub-round – sub-angular) with lenses of sandy clay, also likely to be made ground.

Below this and to the bottom of the trial pit at 2.20m there was a sandy bluish grey alluvial clay with silt and gravel at a similar size to the gravel encountered in the layer above.

- 2.1.5 **TP03:** TP02 was located within the western EA waste management compound ~19m south southeast of TP02 and reached a depth of 2.20m. From 0.00m to 0.10m there was topsoil consisting of mid-dark greyish brown slightly sandy clayey silt with grass roots and rootlets. Below this from 0.10m to 0.50m was a yellowish / orangey brown clayey gravel (round – sub angular) and sand (medium-coarse) representing made ground / redeposited superficial sands and gravels. Below this from 0.50m to 1.90m was mid bluish grey organic sandy (medium) silt with frequent gravel inclusions. Becoming increasingly sandy with depth there was a gradual change in the colour of the deposit past 1.25m to a darker bluish grey eventually becoming mottled with a mid brown, likely representing differentiation in levels of gleying but still alluvial, but redeposited, in nature. Between 1.90m and 2.10m there was a dark bluish grey gravel (round to sub-round) and sand (medium to coarse). This became darker with depth past 2.10m eventually becoming peaty silty clay alluvium. Samples were taken at 1.00m and 2.10m.
- 2.1.6 **TP04:** TP04 was located ~24m east northeast of TP03 within the western EA compound in an area known to have formally been a garden for the Holme Sluice operators house (demolished c. 2005) and reached a depth of 2.20m. From the grass turn surface at 0.00m to 0.10m there was mid-dark greyish brown slightly sandy clayey silt with grass roots and rootlets, being topsoil. Between 0.10m and 0.20m there was a levelling layer of made ground consisting of clinker/ash, brick and glass fragments as well as a synthetic matting. Below this from 0.20m to 0.60m was a mixed gravelly clayey mid brownish grey subsoil with glass, clinker and gravel, similar to that above but separated by the synthetic matting. It is likely this also represents made ground. Between 0.60m and 1.85m was mid orangey greyish brown sandy (medium) clay with gravel (round – sub-round). Past 1.00m this became more of clayey gravel and became lighter in colour past 1.20m as the gravel content increased. Water began to seep in rapidly at 1.30m. It is likely this also represents made ground including mixed redeposited superficial sands and gravel with subsoils. At 1.85m to the trial pit base at 2.20m was mid-dark sandy (medium-coarse) bluish grey silt with clay, representing alluvium. A sample was taken at 1.90m
- 2.1.7 **TP05:** TP05 was located ~16m south southeast of TP04 still within the same garden area immediately to the west of the current eastern EA compound and reached a depth of 2.20m. From 0.00m to 0.20m there was topsoil consisting of mid-dark greyish brown slightly sandy clayey silt with grass roots and rootlets. Below this between 0.20m and 0.60m was a mixed gravelly clayey mid brownish grey subsoil with glass, clinker and gravel similar to that encountered in TP04, likely representing made ground. From 0.60m to 0.80m there was mid orangey greyish brown sandy (medium) clay with gravel (round – sub-round). From 0.80m to 1.70m this became a silty gravel and sand with rapid water seepage at 1.55m From 1.70m to 2.20m was a mid-dark bluish grey silt with clay similar to that encountered in TP04, representing alluvial deposits.
- 2.1.8 **TP06:** TP06 was located ~27m east northeast of TP02 on the northern side of River Road / Swan Meadow and reached a total depth of 2.00m. From 0.00m to 0.20m there was topsoil consisting of mid-dark greyish brown slightly sandy clayey silt with grass roots and rootlets. From 0.20m to 1.10m there was mid-dark orangey greyish brown sand (medium) and gravel (round-sub rounded) with some clay. Some organics and roots are present from above and it likely represents made ground / subsoil. From 1.10m to 1.90m there was very loose sandy gravel with less clay of a similar description to the above layer and also represents made ground and probable redeposited superficial deposits. From 1.90m to 2.00m there was a clear change to a firm dark bluish grey sandy (medium-coarse) and gravelly organic silt and clay. There appeared to be some laminations of sand and unlikely to be reworked and appeared fairly well sorted.
- 2.1.9 **TP07:** TP07 was located ~28m east northeast of TP06 immediately to the west of a wooded area and reached a maximum depth of 2.10m. From 0.00m to 0.30m there was topsoil consisting of mid-dark greyish brown slightly sandy clayey silt with grass roots and rootlets and also contained frequent gravel, and is likely in part made ground. From 0.30m to 0.70m was mid orangey brown clayey sand with silt and some organic inclusions and represents made ground. Below this from 0.70m to 1.20m was a made ground clinker layer containing brick fragments

and rubble, ash and gravel. From 1.20m to 2.10m was a reworked and heavily contaminated (hydrocarbons) alluvium consisting of dark slightly bluish grey silt and clay. Within this was gravel, sand, brick and clinker/ash. Beyond 1.80m there were less inclusions and contamination whilst becoming more organic, well sorted and more like deposited alluvium.

- 2.1.10 **TP08:** TP08 was located ~35m east northeast of TP08 within a wooded area and reached a total depth of 1.55m. From 0.00m to 0.20m there was topsoil consisting of dark brown humic sandy silt with organics / roots / rootlets. From 0.20m to 0.90m there was firm mid yellowish brown clayey silt with occasional small rounded pebbles, becoming stiff past 0.70m. From 0.90m to 1.35m there was a stiff to very stiff dark brownish grey gravelly silt with clay lenses. Brick fragments were observed in the upper portion of this layer. Past 1.00m this becomes lighter and more gravelly. From 1.35m to 1.55m there was stiff bluish grey clayey silt with occasional sand (fine). This likely represents desiccated alluvium but could also be reworked / redeposited alluvium.
- 2.1.11 **TP09:** TP09 was located ~25m southeast of TP08 within a smaller wooded area immediately to the west of the western EA compound and reached 1.55m in depth. From 0.00m to 0.10m there was topsoil consisting of dark brown humic sandy silt with organics / roots / rootlets, interpreted as topsoil. From 0.10m to 1.00m there was firm mid yellowish brown clayey silt with occasional small rounded pebbles and roots from above, likely to be subsoil and possibly made up ground. From 1.00m to 1.20m there was gravelly (round – sub-round) clay with silt. Past 1.20m this becomes slightly darker and with a lack of gravel but occasional brick fragments. From 1.20m to 1.30m there was a dark humic band of silty clay. From 1.30m – 1.55m there was a reddish brown/grey gravel (rounded – sub rounded) and sand (medium-coarse). Within this there was a large concrete boulder at ~1.50m. Past 1.50m the gravel became darker, hinting at the possibility of alluvium below and becoming more organic. It is likely this gravel is made ground.
- 2.1.12 **TP10:** TP10 was located ~15m east of TP09 on the grass bank close to the sloping masonry on the north side of the River Trent, reaching a total depth of 2.00m. From 0.00m to 0.10m there was topsoil consisting of mid brown humic sandy silt with organics / roots / rootlets, interpreted as topsoil. From 0.10m to 1.10m there was orangey grey/brown silty clay with gravel (round – sub rounded). From 1.10m to 1.30 this becomes clayey gravel with evidence for gleying after 1.30m. From 1.30m to 1.65m this becomes sandy gravel with occasional clay lenses and becoming darker with depth. From 1.65m to 1.80m this becomes stiff gravelly dark grey humic clay. Beyond 1.80m this becomes more organic with no gravel but frequent sand (medium), likely representing the start of alluvial layers. Past 2.00m this becomes bluish grey and very stiff.
- 2.1.13 **TP11:** TP11 was located ~19m north of TP08 within the wooded area immediately west of an unused car park to a depth of 1.50m. From 0.00m to 0.10m there was topsoil consisting of mid brown humic sandy silt with organics / roots / rootlets. From 0.10m to 0.30m there was orangey/yellowish brown silty clay subsoil. Between 0.30m to 1.00m there is a clear change to mid reddish brown slightly sandy gravelly clay with silt, likely representing made ground. There as a band of rounded- sub-rounded gravel between 0.80m and 1.00m. Below this from 1.00m to 1.50m was dark bluish grey sandy clay. This is contaminated throughout with hydrocarbons and was poorly sorted and is likely made ground consisting of reworked / redeposited alluvium.
- 2.1.14 **TP12:** TP12 was located ~30m east of TP11 on the southern extent of the disused car park and reached a total depth of 2.30m. From 0.00m to 0.10m there was topsoil consisting of dark greyish brown sandy silt with gravel inclusions, roots and rootlets. Below this from 0.10m to 0.30m was mid yellowish brown artificial sand and gravel using as a levelling layer, presumably in the creation of the now disused car park. Between 0.30m and 0.65m there was a mid reddish brown sandy silt with clay which is also likely to be levelling layers and therefore made ground. From 0.65m to 1.10m this changes to mid brownish grey clayey gravel (round – sub-round) which also contains brick fragments and also represents made ground. From 1.10m to 1.75m there was dark bluish grey very stiff sandy alluvial clay. From 1.75m to 2.30m there was light-mid mottled yellowish/orangey brown sandy clay with silt, becoming sandier with depth. Past 2.10m this became dark bluish grey again. It is possible this represents alluvium but it is more likely that it has been reworked / redeposited.

- 2.1.15 **TP13:** TP13 was located ~35m northeast of TP13 immediately west of the entrance to the unused car park and reached a total depth of 1.50m. From 0.00m to 0.20m there was topsoil consisting of dark brown humic sandy silt with lots of organics / roots / rootlets. Between 0.20m and 0.65m there was mid yellowish brown slightly silty sand (medium – coarse) with occasional gravel (rounded –sub rounded), more than likely being made ground. From 0.65m to 1.05m there was firm/stiff dark brownish grey slightly sandy clay with silt. This contained modern glass fragments, with organics throughout as well as fragments of brick and rubble. This represents made ground. From 1.05m to 1.30m this was the same with the absence of objects constituting made ground. From 1.15m onwards there is no longer gravel. From 1.30m to 1.50m was dark bluish grey very stiff silty clay. This was humic and is likely to be alluvially deposited.
- 2.1.16 **TP14:** TP14 was located ~46m north northeast of TP10 on the grass bank to the north of the River Trent and opposite the entrance to the unused car park, reaching a total depth of 2.50m. From 0.00m to 0.20m there was topsoil consisting of mid brown humic sandy silt with organics / roots / rootlets. From 0.20m to 0.50m there was orangey grey/brown silty clay with gravel (round – sub rounded) with brick fragments and rare gravel, likely reflecting made ground. From 0.50m to 1.10m there was mid greyish brown stiff clay. Within this there were large cobbles of concrete. At 0.70m there was reddish brown clay, being made ground. Past 1.10m to 2.30m there was stiff dark greyish sandy alluvial clay with macros. This becomes lighter and less stiff past 1.60m and not organic or sandy becoming firm. Past 2.30m to 2.50m there is was mottled mid orangey / bluish brown grey gleyed sandy clay, likely representing alluvium.

2.2 Boreholes

- 2.2.1 None of the boreholes were observed directly due to casing being used throughout, making monitoring of the sediment as it was extruded impossible due to the samples being sealed within the metal casing. The driller's and engineering geologist's logs were consulted and the interpretation follows, alongside the observations from the trial pits.

Borehole	Easting	Northing	Height (AOD)	Total Depth (m)
BH01	461292	339356	22.74	9.00
BH02	461284	339371	22.87	9.00
BH03	461330	339403	22.42	8.00
BH04	461326	339414	21.95	8.00
BH05	461385	339415	21.89	9.00

Table 2: Location, height and depth of boreholes.

- 2.2.2 **BH01:** BH01 was located ~17m southwest of TP05 within the western EA compound. The total depth reached was 9.00m

From 0.00-0.20m there was topsoil followed by subsoil from 0.20-0.50m. From 0.50-1.80m there was made ground consisting of soft to firm dark brown slightly sandy and very gravelly clay. Gravel is sub-angular to sub-rounded fine to medium and contained brick. This is likely to be redeposited superficial terraced gravels used to build up the ground.

From 1.80-4.20m there was firm to stiff dark grey mottled dark brown slightly sandy slightly gravelly (sub-rounded fine to coarse) silt. This becomes slightly sandy silt after 2.90m. From 4.20-8.00m there were brown-grey sands and gravels. The gravels were fine to medium, sub-angular to rounded, fine to coarse. There were occasional cobbles of sandstone up to 0.15m. From 6.30m this changes to dark grey brown sandy gravel, fine to medium and sub-angular to rounded. These represent the Holme Pierrepont Sands and Gravels. From 8.00-9.00m weathered fine-medium mudstone, brownish red, slightly sandy and very gravelly (angular-sub angular) was encountered. This represents the bedrock geology of Gunthorpe Mudstone.

One sample was observed from between depths of 3.00-4.00m. Between 3.00 and 3.37m there was no recovery. From 3.37-3.80m there was mid brownish grey silty clay with possible silt laminations. Sand (fine) increased with depth. From 3.80m to 3.90m this becomes sandy clay with frequent iron panning and slightly laminated with the sand becoming medium. From 3.90m to 3.40 was humic silt and becoming slightly darker.

- 2.2.3 **BH02:** BH02 was located ~17m north northwest of BH01 within the western EA compound. The total depth reached was 9.00m.

From 0.00-1.80m there was made ground consisting of: grey brown sandy gravel and fine-coarse brick fragments, concrete and limestone chipping from 0.00-0.35m; brown soft sandy clay from 0.35-0.55m; and brown-black, ashy/clinker gravelly sand as well as brick and sandstone fragments between 0.55-1.80m. It is likely these layers are a result of works relating to the construction of Holme Sluice and associated works but could also be related to the later phases of gravel extraction.

From 1.80-4.30m there was dark grey, slightly gravelly (sub-angular to sub-rounded) very clayey sand, representing alluvially deposited sediments. From 4.30-8.30m there were brown grey sands (fine-medium) and gravels (sub-angular to rounded). From 7.00m this changes slightly to brown slightly sandy gravels. These are the Holme Pierrepont Sands and Gravels. From 8.30-9.00m there was weathered mudstone recovered as brown red gravelly clay, representing the Gunthorpe Mudstone bedrock.

A single sample was observed during the extruding of the samples between the depths of 2.00 and 2.45m. From 2.00m – 2.23m there was no recovery. From 2.23-2.41m there was dark brown silty clay with fine sand as well as hydrocarbon contamination. From 2.41-2.45m there was possible laminated sand, however, the extent of this could not be seen as the sample was unable to be split for closer inspection due to it being needed for geotechnical testing.

- 2.2.4 **BH03:** BH03 was located ~56m east northeast of BH02 inside the eastern EA compound car park, just offset from the gated entrance. The total depth reached is was 8.00m

From 0.00-1.50m there was made ground consisting of: tarmac between 0.00-0.18m; black brown ashy/clinker gravelly sand with brick, tarmac and sandstone fragments from 0.18-0.55; black grey brown slightly clayey gravelly sand with brick and sandstone from 0.55-1.50m. Between 0.80-1.50m hydrocarbon contamination was observed.

From 1.50-4.90m there was firm brown grey, slightly silty slightly gravelly (sub-angular to sub-rounded) sandy (fine to medium) clay. Between 3.80-4.70m this changes to soft to firm, brown grey black mottling, slightly sandy slightly gravelly clay with plant macros. From 4.70-4.90m this becomes very soft, dark grey black, organic clay. These represent alluvially deposited sediments. From 4.90-7.20m there were brown grey sands (fine to medium) and gravels (sub-angular to rounded), representing the superficial Holme Pierpont Sands and Gravels. Below this, from 7.20-8.00m, was weathered mudstone recovered as brown red gravelly clay, being the Gunthorpe Mudstone bedrock.

Two samples were observed from 2.00-2.45m and 2.70-3.15m. From 2.00-2.45m there was very stiff dark greyish brown clay with very fine silt and sand. It is structureless and likely to be reworked as well as being contaminated by hydrocarbons. Between 2.45-2.70m there were no samples to observe however, between 2.70-3.15m the description is the same. Within this between 2.90 and 3.05 there was a coarse quartz sand band with silt, still dark greyish brown and slightly less contaminated than the silty sandy clay above. From 3.05 to 3.15 there was a humic silt of similar colour to that above with less sand.

- 2.2.5 **BH04:** BH04 was located ~11m north northeast of BH03 outside the eastern EA compound in between River Road / Swan Meadow and the gated entrance. The total depth reached was 8.00m.

From 0.00-1.70m there was made ground consisting of: tarmac from 0.00-0.18m; dark grey black, gravely cobbly fine to medium sand. Gravel, angular to sub-rounded, brick fragments, concrete, sandstone and clinker from 0.18-0.60m; and dark grey brown, gravely slightly clayey ashy/clinker sand (fine-coarse) and gravel (sub-angular – sub-rounded) with brick, ash, sandstone, mudstone and clinker between 0.60-1.70m.

From 1.70-3.90m there was firm to stiff, dark grey brown, gravely (sub-angular - sub-rounded) slightly sandy (fine-medium) clay. This changes after 2.40m to soft dark grey brown sandy slightly gravelly clay. From 3.90-7.00m there were brown grey sands (fine to coarse) and gravels (sub-angular to rounded), representing superficial Holme Pierpont Sands and Gravels. From 7.00-8.00m weathered mudstone was recovered as brown red gravelly clay, representing the Gunthorpe Mudstone bedrock.

One sample was observed between 3.00-4.00m. From 3.00 to 3.45m there was no recovery. Between 3.45 and 3.87m there was dark brown silty clay with silt and fine sand as well as contamination from hydrocarbons. From 3.87 to 4.00m there were laminated bands of coarse sand and humic silt. The silt was humic and platy and the same was angular and medium-coarse.

- 2.2.6 **BH05:** BH05 was located ~59m east of BH04 located on the northern bank of the River Trent in close proximity to the location of TP10, reaching a total depth of 8m.

From 0.00-1.70m there was made ground consisting of: grass over loose brown clayey sand with roots/rootlets from 0.00-0.15m; medium dense orangey brown slightly clayey sand with occasional roots/rootlets between 0.15-1.20m; and brown clayey very sandy (fine to coarse) gravel (sub-angular to rounded) as well as brick from 1.20-1.70m.

From 1.70-4.00m there was firm dark brown mottled dark grey slightly sandy clay, becoming soft dark brown mottled greenish brown slightly sandy clay after 3.40m. From 4.00-6.70m there was very dark brown sandy (medium-coarse) gravel (sub-rounded to rounded), representing the superficial Holme Pierpont Sands and Gravels. From 6.70-9.00m there was completely weathered mudstone recovered as firm slightly gravelly clay, representing the Gunthorpe Mudstone bedrock.

Two samples were observed from 2.00-2.45m and 7.00-7.45m. From 2.00-2.12 there was mid brown clayey silt representing made ground. From 2.12 to 2.45m this becomes dark greyish brown silty clay with rare silt and fine sand. It is also likely that this is made ground towards the top of the alluvially deposited layers. From 7.00-8.00 was the mudstone bedrock.

2.3 Sampling

- 2.3.1 A full explanation of the sampling strategy is detailed in the WSI (Keyworth and Stein 2017).

Trial pits

- 2.3.2 A total of four samples were taken from the 14 test pits. TP03 at 1.00m and 2.10m, TP04 at 1.90m and TP05 at 2.00.
- 2.3.3 Sampling the trial test pits was problematic. The majority of the trial holes consisted of made ground, some of which was contaminated (as observed in TP01, TP07 and TP11). Samples were therefore only taken within the sediment once they were established to be alluvially deposited. This was also problematic as this often came in at depths beyond 2.00m, meaning hand sampling or auger coring beyond the depth of the trial pit was not possible. Samples were taken mainly where there were organic remains present in the hope of obtaining a dateable sample.

Boreholes

- 2.3.4 Sub-samples were recorded and obtained during the extruding of sediment from casing. Seven samples were observed: BH01 3.00-4.00m; BH02 2.00-2.45m; BH03 2.00-2.45m, 2.70-3.15m; BH04 3.00-4.00m; BH05 2.00-2.45m, BH05 7.00-7.45m.
- 2.3.5 From the extruded samples, sub-samples were taken: BH01: 3.80-3.90m and 3.90-4.00m; BH02: N/A; BH03 2.90-3.05m and 3.05-3.15m; BH04: 3.72-3.76m and 3.87-4.00m; and BH05: N/A. Samples were not taken from BH02 due to the sample being too small to sub sample and from BH05 due to it being mudstone bedrock.

2.4 Discussion

- 2.4.1 No archaeological deposits or features were observed or encountered during the course of the trial pitting. The trial pits revealed the nature and extent of the surface and sub-surface sedimentary profile across the Proposed Development Area whilst the boreholes provide indications as to the depth and extent of the alluvial sediments, superficial sands and gravels as well as the depth of the mudstone bedrock.
- 2.4.2 Below the topsoil and subsoil there is reasonably extensive made ground consisting of bricks, rubble, ash, clinker as well as reworked alluvium, and redeposited superficial sands and gravels. Across the site there was a high level of contamination within the made ground layers, especially within the reworked alluvial layers below reworked sands and gravel. It is likely that these contaminants, in the form of hydrocarbons, were contained within the made ground layers and have leached downwards into the redeposited sands and gravels and reworked alluvium. This was observed both in trial pits and boreholes to maximum depths of ~4.00m showing extensive contamination.
- 2.4.3 Below the made ground layers were alluvially deposited clays, silts and sands. The extent of these could be seen in the five boreholes but unfortunately do not provide a full profile of the development area due to their clustered location in the centre of the site. The driller's and engineering geologist's logs were consulted with regards to the alluvial deposits encountered below the depth of the trial bits and provide a broad sequence, alongside the observed extruded samples, as to the nature of the sediments.
- 2.4.4 Below alluvial layers were the superficial Holme Pierrepoint Sands and Gravels before the eventual Gunthorpe Member Mudstone sedimentary bedrock. Similarly, as with the alluvial layers, the full character and extent of the sands and gravels cannot be fully explored due to the nature of shell and auger drilling, as well as logs being produced for interpretation for engineering rather than an archaeological or geomorphological perspective. No samples of sands and gravels were recovered during the extrusion of the samples. The profiles and sections of the sedimentary profiles will be discussed further below (2.4.9).
- 2.4.5 The current course of the River Trent is only relatively recent. The river previously meandered 2286m from the current location of the main water entrance to Colwick Marina, some 550m southeast of TP01, to a small managed channel which now flows into the Trent downstream of the Holme Sluice, approximately 55m east of TP14 (Brazier *et al*, 1984). This channel is the remains of the meander (the Old Loop) and mirrors the previous course of the Trent, and is all that remains of the previous channel. The meander was partially by-passed in 1800 with the construction of the Holme Cut (Fisher 2013: 69). This consisted of a canalised stretch of water allowing for the passage of small river craft bounded by the Upper Holme Lock and the Lower Holme Lock. The meandering course of the Trent still existed until the construction of the Holme Sluice, largely completed in 1953 and opened officially in 1955. The meanders were cut

off and by-passed when the Holme Cut was straightened to form a 640m course and widened from 24.4m to 91.4m (Brazier *et al.* 1984: 16). Following this, the area now created in between the current course of the Trent and the previous meandering course, known as the Old Loop, were subject to terrace gravels extraction until the 1980s under Trent Concrete (Symonds and Copper 2014).

- 2.4.6 Historical mapping suggests that areas of extraction were confined to the present-day location of the lakes at Colwick Country Park. It is therefore possible to suggest that the potential development area has not been altered substantially and that alluvial layers below the made ground, as well as the sands and gravels below this, are undisturbed and have a high potential for archaeological significance. They may in fact be masked and therefore protected by the made ground layers lying directly above the alluvially deposited sediments.
- 2.4.7 The archaeological potential at Colwick has been firmly demonstrated; mainly thanks to the work of Chris Salisbury who monitored the gravel extraction at Colwick throughout the 1970s (Salisbury 1979; Salisbury *et al.* 1984). There is a clear need to monitor any groundworks that may take place which would expose the true alluvial sediments and considering the depth of the gravels (~4.00m) it is probable that wooden objects and structures, such as the previously observed fish weir, may be present that would be of major regional importance (Knight and Spence 2013: 30).
- 2.4.8 It was always unlikely that trial pits and boreholes would further elucidate archaeological features or artefacts but had potential to provide valuable information with regards to geomorphology as well as the impact of recent land use on sub-surface archaeology.

Cross-sections

- 2.4.9 Three cross-sections of the site were produced from the trial pit and borehole logs:
- **Cross-section A-B:** The cross-section (Figure. 3) runs from southwest (A) to northeast (B) and consists of TP01, TP02, TP06, TP07 and TP11. The ground surface is relatively flat from 22.94m at TP01 (A) to 22.83m at TP02 before gradually reducing to 21.25m at TP11 (B) across the profile. This is mirrored broadly by the extent and depth of the made ground and alluvial deposits, when visible. This is to be anticipated due to the most recent channel of the Trent being located within the projected alignment of the cross section. The current channel of the Trent is artificial and consequently shows no drop off on modelled northwest-southeast sections.
 - **Cross-section C-D:** The cross-section (Figure. 4) runs broadly across the middle of the site from west northwest (C) to east northeast (D) encompassing TP01, TP03, BH02, TP04, BH03, BH05 and TP14. From (C) at TP01 across to TP04 the ground level changes very little from 22.94m to 22.95m. From TP04 at 22.95m the ground level gradually reduces to 21.25m. The level of made ground below the top/sub soil mirrors this profile. Below this the alluvial sediments appear to also broadly follow this pattern, reducing in depth gradually across the profile from C-D, although the thicknesses vary. This could be a potential palaeochannel, centered somewhere in profile with BH03, but could also represent natural undulations. The superficial sands and gravels mirror the alluvial sediment profiles as does the mudstone bedrock.

Similarly to the cross-section A-B the profile of C-D is orientated broadly towards the profile of the previous channel of the Trent prior to it being diverted / by-passed.

- **Cross-section E-F:** The cross-section (Figure. 5) runs broadly through the middle of the site from south southeast (E) to north northeast (F) from BH01, TP04, BH04, TP08 and TP12. The ground surface at BH01 (E) is 22.74m, rising slightly to 22.95m at TP04 before dropping off to 21.70m at TP08 and levelling off to 21.72m at TP12 (F). It would be

anticipated, based on the previous cross sections, that should the profile continue beyond F it would steadily drop off again as it approaches the previous channel of the Trent. The slightly more extensive made ground at TP04 is likely to be a result of extensive landscaping during the construction of the Holme Sluice, but otherwise the made ground mirrors the ground surface profile. The depths and extents of the alluvial sediments hint at the expected drop off moving from E to F. The levels of superficial sands and gravel remain relatively consistent as does the mudstone bedrock which is to be expected considering this was once floodplain and a reasonable distance from the once-natural channel.

3 CONCLUSIONS

3.1 Summary

3.2 Recommendations

- 3.2.1 Despite there being no archaeological observations it seems clear that during the wider undertaking of the main works regarding the construction of the fish pass that continuous archaeological monitoring should be undertaken. The reasons for this have been highlighted above in detail but there is the potential for undisturbed ground below the present layers of made up ground which is located directly on top of natural alluvial layers between 1.30-2.30m below ground level. The archaeological significance of the area is high as is the potential for archaeological survival, as demonstrated by the earlier findings of monitoring gravel extraction (Knight and Spence 2013).
- 3.2.2 It has been demonstrated that alluvial layers are present from 1.30m and 2.30m below ground level to depths of ~4.00m where the top of the terrace gravels begin. Therefore any sub-surface impacts that are likely to expose alluvial deposits or superficial gravels should be subject to continuous monitoring in the form of a watching brief where any archaeological horizons or, more likely, features and remains, may be encountered.
- 3.2.3 If no further impact is to occur at a depth of 1.30-2.30m below ground level then the recovered samples could be investigated to see what additional information could be gained with a view to potential dating of alluvial layers with significant organic deposits.

APPENDIX

Figures

Images

TP01



TP02



TP03



TP04





TP05





TP06





TP07



TP08



TP09



TP10



TP12



TP13



TP14





Samples

Samples extruded from borehole casing

BH01:

3.00-4.00m





BH02:

2.00-2.45m



BH03:

2.00-2.45m



2.70-3.15m



BH04:

3.00-4.00m



BH05:

2.00-2.45m



7.00-7.45m



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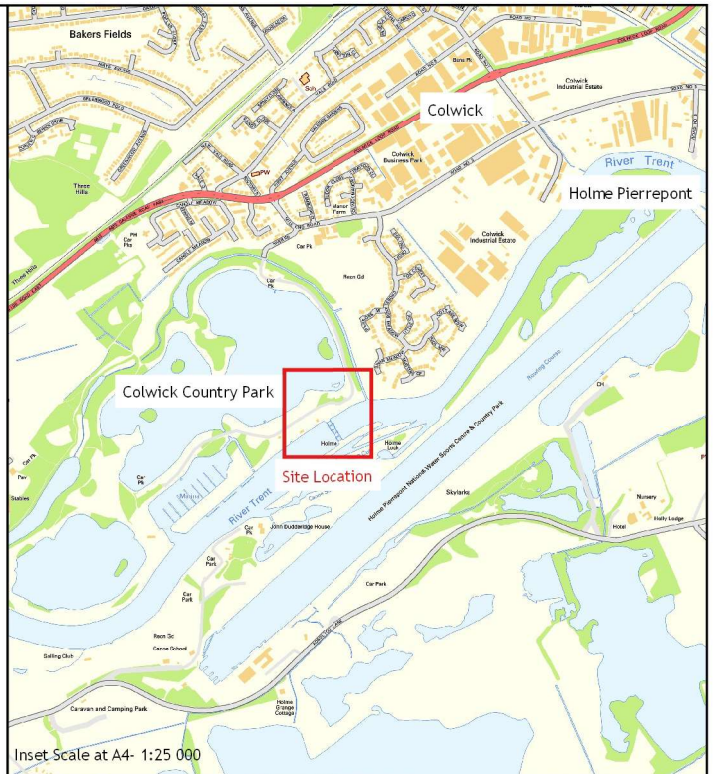
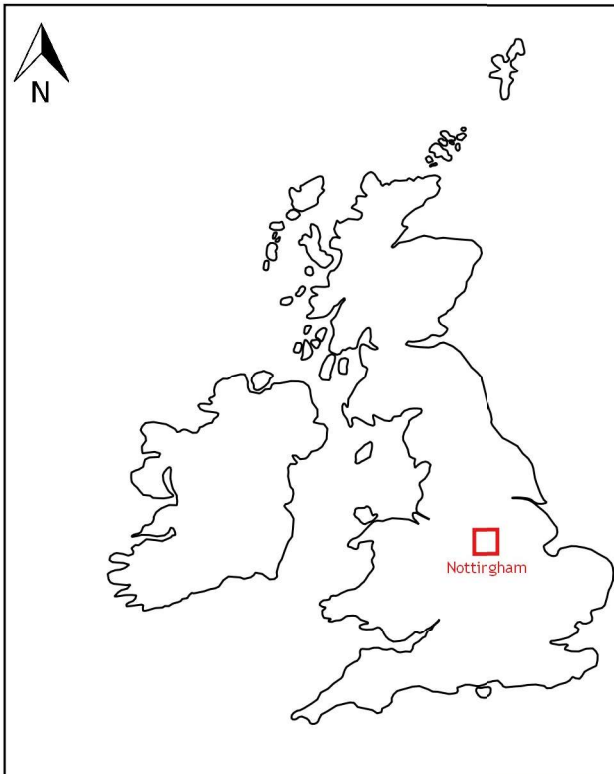
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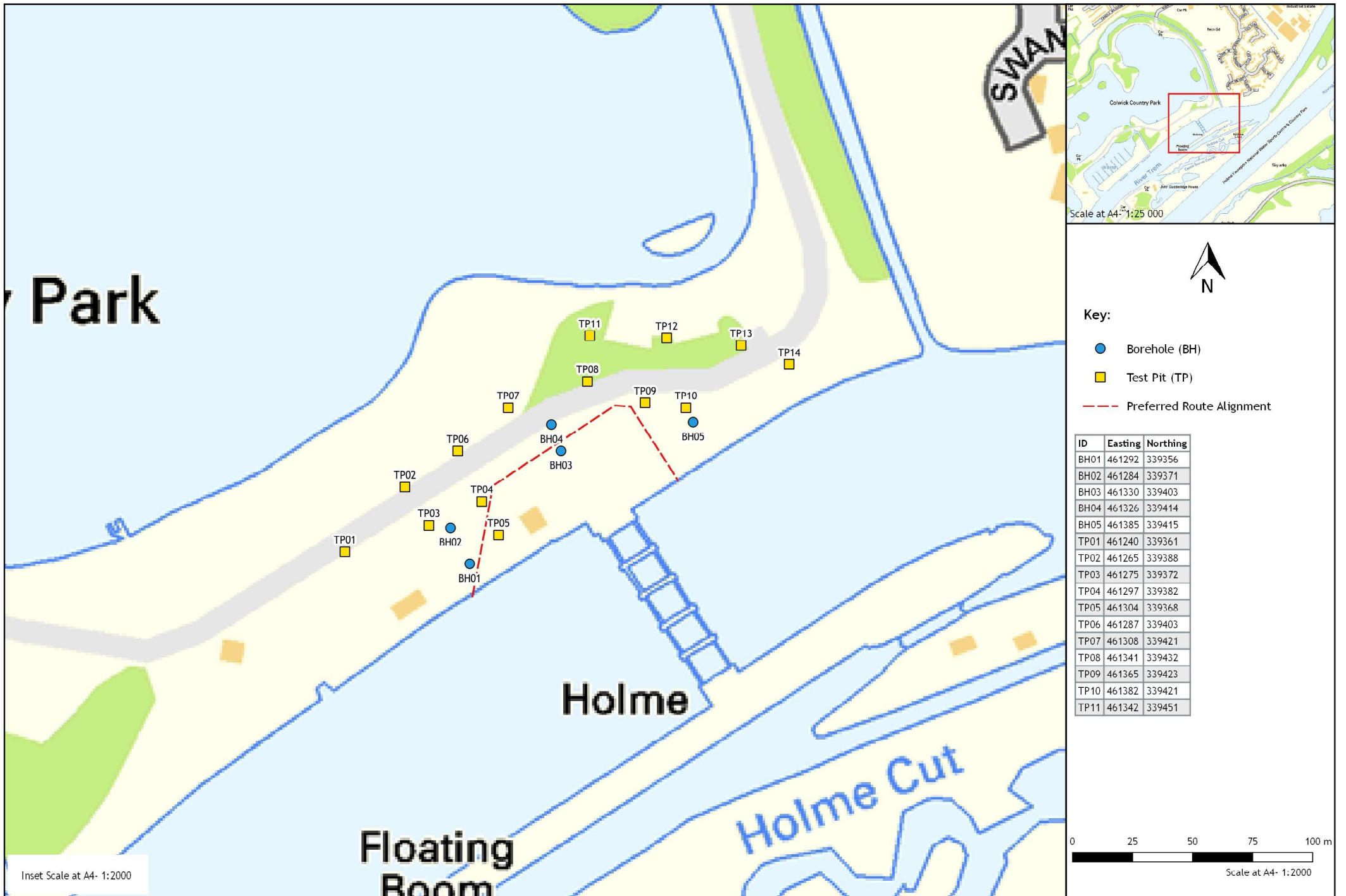
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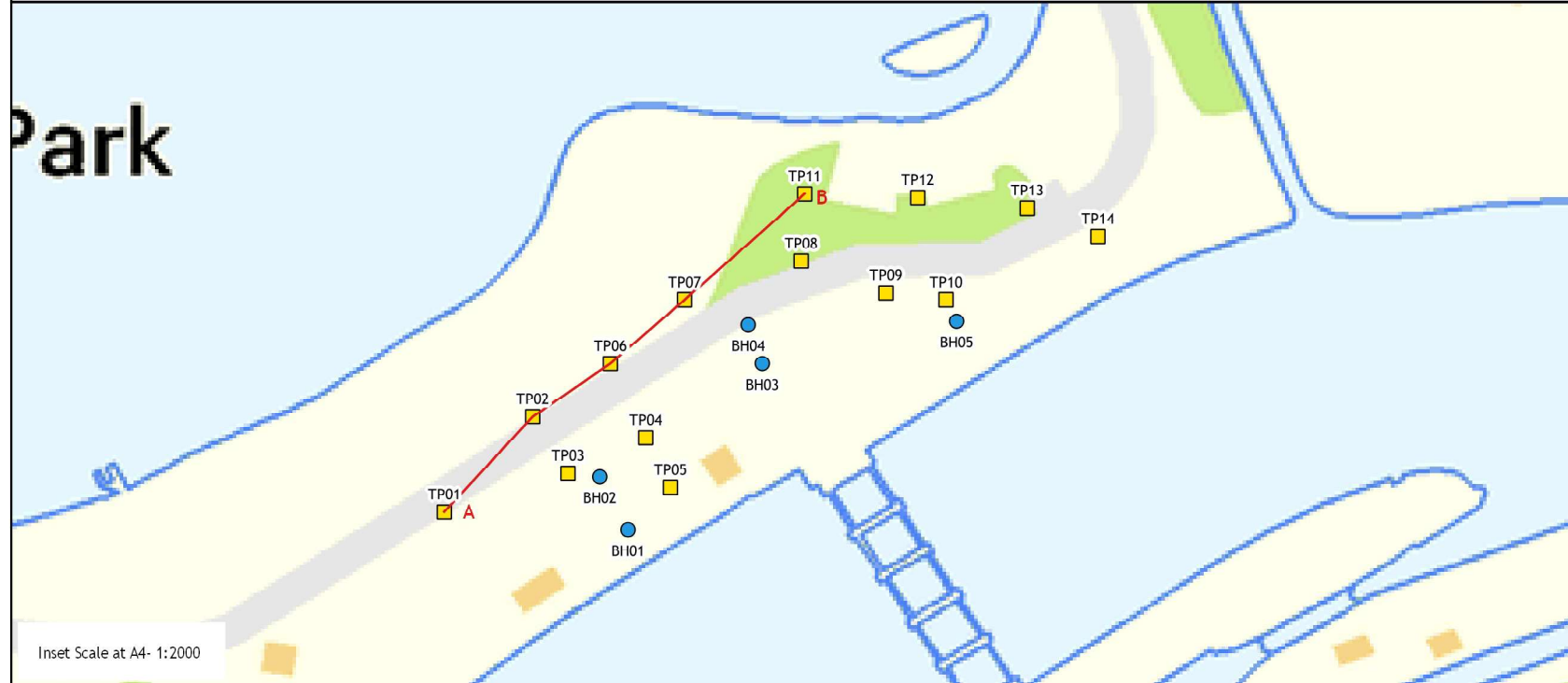
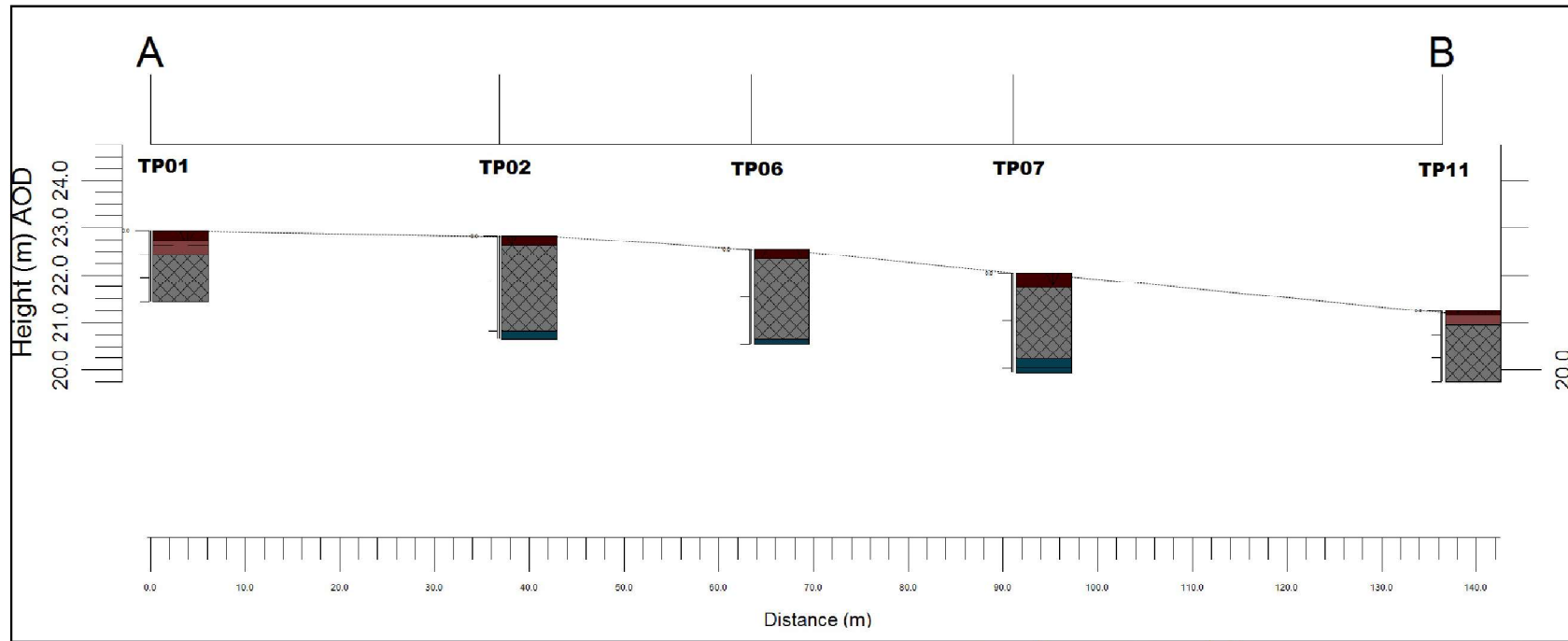
- Key:**
- Borehole (BH)
 - Test Pit (TP)
 - - - Preferred Route Alignment

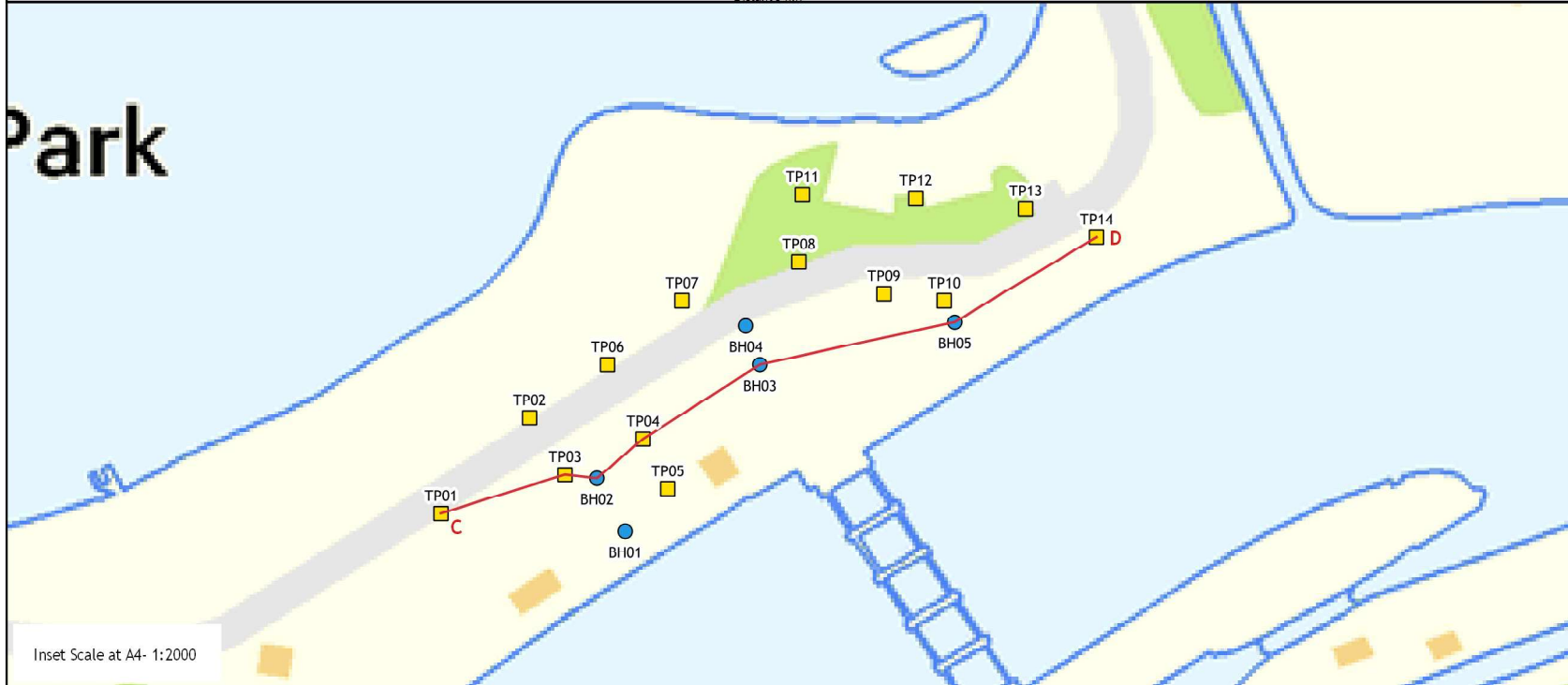
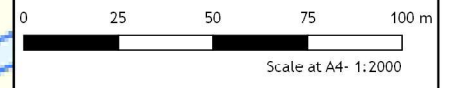
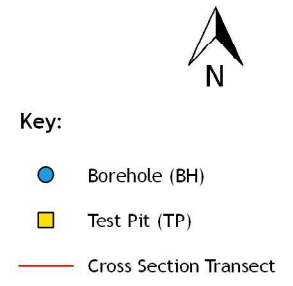
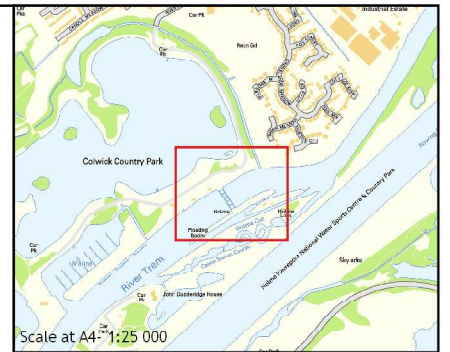
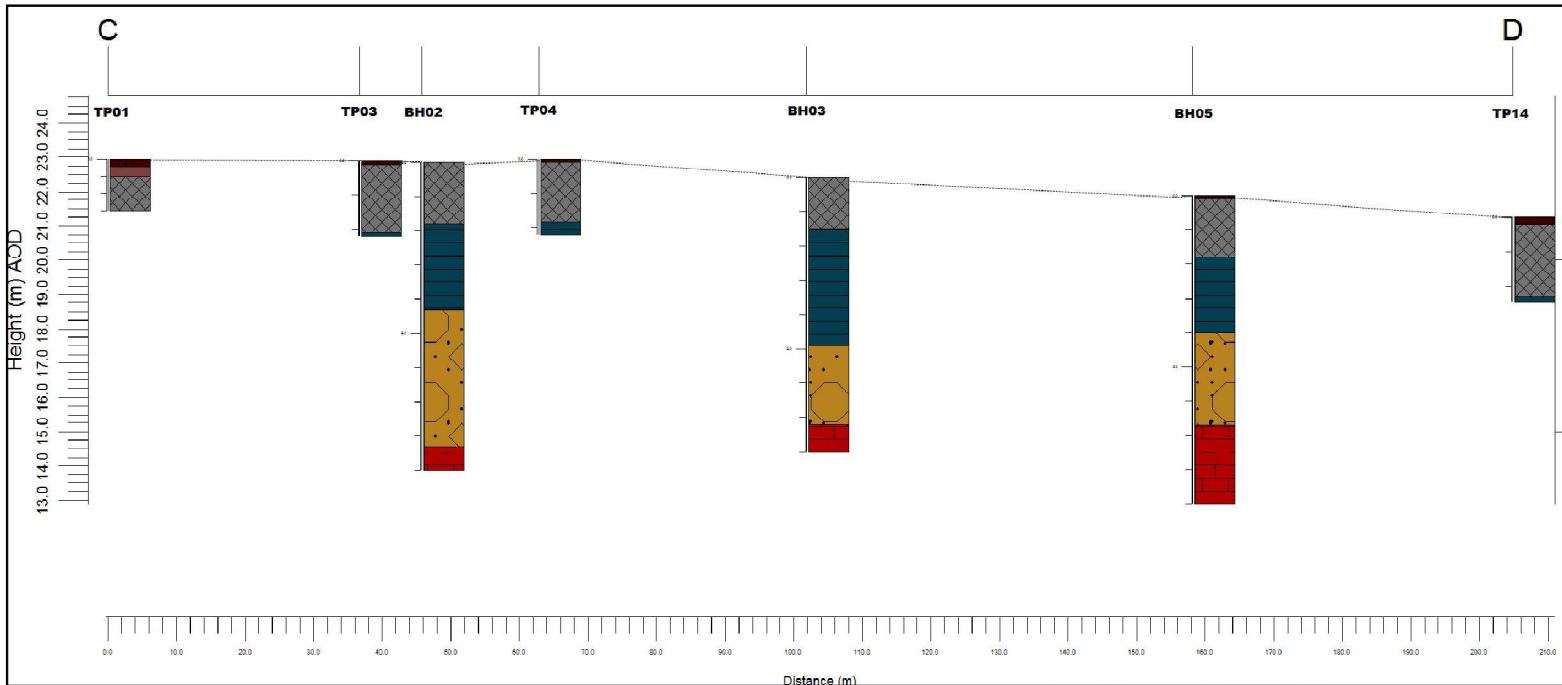
ID	Easting	Northing
BH01	461292	339356
BH02	461284	339371
BH03	461330	339403
BH04	461326	339414
BH05	461385	339415
TP01	461240	339361
TP02	461265	339388
TP03	461275	339372
TP04	461297	339382
TP05	461304	339368
TP06	461287	339403
TP07	461308	339421
TP08	461341	339432
TP09	461365	339423
TP10	461382	339421
TP11	461342	339451

Inset Scale at A4- 1:2000



HSF
 Figure 02
 Scale at A4- varies
 Holme Sluice Fish Pass Colwick
 Site Plan Depicting Locations of Boreholes and Test Pits
 Drawn by: TK/RT





Inset Scale at A4: 1:2000

