Ecological and Stratigraphic Review, Catfield Fen

on behalf of Mr & Mrs Tim Harris

May 2013

thelandscapepartnership
landscape architecture urban design environmental planning

Introduction

This brief report has been prepared to summarise the results of a small-scale peat stratigraphy survey at Catfield Fen, which took place in late May 2013. The survey work was commissioned by Mr and Mrs Tim Harris, 'The Client'. The purpose of the survey was to determine gross stratigraphy of the superficial deposits in the east of Catfield Fen, namely north, Middle and South Marshes and Mill Marsh, over the course of a day. Casual, informal observations of the management and condition of the fen were also made.

Objectives

The Client requested that a brief hand augur survey of the fen be carried out to contribute to understanding of the peat stratigraphy, to approximately identify presence or absence of any turbary and Breydon Formation clay in the areas surveyed, and to determine the degree of hydrological connectivity between the underlying Norwich Crag deposits and the peat which overlays these deposits, insofar as this can be determined through augur survey alone. The Client further requested that comment be made upon any changes in the fen vegetation in a c20 year period between when the site was last visited by one of the surveyors in 1991 and the present day. Comments arising from this comparison result from visual observation only, and not from quantifiable data.

The objectives of this study are therefore as follows:

- to identify, characterise and describe the gross superficial stratigraphic sequences in the area surveyed
- to undertake initial interpretation of the findings
- to provide a detailed report of the survey findings, sufficient to enable identification of any requirement for further site investigation
- to visually compare the vegetation in 1991 with the vegetation as observed in 2013
- to comment upon possible trends in vegetation development at the site

Methodology

Field survey was undertaken on 21st May 2013. Gross stratigraphy of the upper 150cm of the substratum beneath North Marsh, Middle Marsh, South Marsh and Mill Marsh was surveyed using a hand auger (a modified Hiller Borer with 32cm chamber). Survey was not undertaken below c165cm of the ground surface.
Six east-west aligned transects were set out across the fen (see Figure 01). Auger survey points were spaced at 50m intervals along these transects. Additional bores were made in areas of particular interest for reasons of vegetation (for example close to the boundaries between *Cladium* and *Juncus* dominated fen. Given the time constraints, one day being available for the work, not all transects were completed and at the conclusion of survey, 15 cores had been recorded.

Fieldwork was undertaken between 10-30 am and 16-30 pm to ensure that light levels were sufficient to distinguish visual field attributes of the ground surface and samples.
Core arisings were examined in the field and recorded in a log showing the sequence of deposits from the ground surface (i.e. depth below '0'm). Core depths was typically taken to:

- a standard depth of 150cm below ground surface; or
- approximately 20cm into the top of the underlying Crag formation deposits where these occur at depths of less than 150cm below ground surface;

Extraction and assessment of the arisings from each core comprised:

- augering the core in c0.25 cm depth sections
- distinguishing discrete sedimentary units within each core by means of macrofabric characters, colour and textural classification;
- identifying and recording unit boundaries within each core by recording a 'below ground level' (b.g.l.) measurement to the nearest five centimetres;
- recording the depth of water within the core when first encountered (ie the watertable depth) to the nearest centimetre b.g.l.

Each core was assigned a unique identifier, made up of the transect identification code and the number of the core within the sequence along the transect.
Sample bags were taken to site for the purposes of storage of wood fragments or other materials out of context/sequence, for possible dating; no wood or anomalous materials which might have been considered unusual or out of context were, however, encountered.
2 person days were required for the completion of the fieldwork stage of this project (2 staff members, Dr Jo Parmenter and Nick Aldus, over 1 day). A third person, Mr Peter Riches, attended on behalf of the client. Coring was carried out using this team, ensuring Health and Safety compliance and effective and efficient survey and recording.

The coring results were recorded on a series of field data sheets which included the unique identifier, coring data, broad vegetation characteristics, location, GPS, the depth of the core, water table height and presence of standing/surface water. It is intended that this information will ultimately be entered into an Excel database. Draft plans were then prepared to an extrapolation of the location of selected types of deposits in plan view, using a variety of symbols and colours. Illustrative transect cross sections will also be prepared showing depths of the various substrate types (i.e. peat, clay, sands/gravels). Figures 02 and 03 show the distribution of turbary and Breydon Formation clay, insofar as this can be identified from such a brief survey. Figures are presented in draft form but could ultimately be updated and revised if and when further data becomes available.

Health and Safety compliance

In accordance with the Management of Health and Safety at Work Regulations 1992, an assessment of the risks to the health and safety of employees of The Landscape Partnership Ltd, whilst they are undertaking survey, and of others who may be affected by the work activities, was carried out and reviewed by a senior member of staff prior to commencement of fieldwork. The Landscape Partnership Safe System of Working on Site form will be completed by the senior staff member responsible for coordinating the fieldwork prior to visiting the site.

The approach to risk assessment can be summarised as follows:

- identify the hazard associated with the work place or work activity;
- evaluate the risks arising from the hazard;
- decide who might be harmed by the activity;
- decide whether existing precautions are adequate, or whether more needs to be done (having regard to the likelihood of the hazard occurring and the seriousness of the risk);
- record any significant findings; and
- review the assessment from time to time, and on any occasions when new equipment or new working practices have been introduced.

Particular hazards at this site include working near water, with risks including drowning, hypothermia and Weils Disease; working on uneven terrain, and working in a reedbed

environment, with the attendant risks of lacerations from leaves and broken stems, and risk of eye injury. Appropriate mechanisms were put in place to ensure that risks were minimised, for example the use of gloves where practicable. Additional risks may come from core sampling, for example muscle strains and sprains. This latter risk was minimised by the use of a lightweight auger (modified Hiller borer).

Limitations

Stratigraphic survey was undertaken over the course of a single day, and therefore should not be taken as a thorough or in-depth investigation of the underlying deposits. The maximum depth of cores was a little over 150cm and so only superficial deposits were considered. This report represents a brief initial review of the stratigraphic data gathered rather than a full account.

Although some botanical recording was undertaken, this was opportunistic, and secondary to the stratigraphic survey, and was further limited by the timing of survey, with some later flowering plants and grasses not being particularly prominent in the vegetation given a late spring in 2013. It is however considered that all species named in the text below are accurately identified. No quantitative recording was undertaken, and no determination of NVC communities was made. Comparison of the present day fen vegetation with that observed by the surveyor in 1991 is therefore informal and should not be taken as definitive.

Whilst the potential for hydrological connectivity between the Crag and the overlying peat was considered during survey, no formal investigation of the permeability of these deposits was undertaken.

Survey results

Survey results will ultimately be tabulated as an Excel spreadsheet to accompany this short report. Findings can be summarised as follows:

Following an unseasonably wet period, the water table at the time of survey typically ranged from c15cm above ground surface to c10cm below ground surface. The fen was typically surface wet, and in most bore locations the water table was about the ground surface.

Immediately below the ground surface the cores variously encountered leaf litter, a moss layer and root mat.

There was little sign of humification of the upper peat deposits, as might occur as a result of prolonged desiccation, except in the eastern part of Middle Marsh. Here, the humified layer extended over tens of centimetres, but is thought most likely to be the result of earlier attempts to drain these marshes rather than evidence of desiccation.

Typical cores then progressed to more or less solid red-brown peat deposits with varying amounts of reed rhizome and roots, and a varying water content.

Around 30% of cores were over old 18th or 19th century turbaries, which varied considerably in depth, with the turf cutting presumed to have removed a proportion of the Upper and Middle Peat, and, in some instances, also resulted in the removal of a thin layer of Breydon Formation Clay. Intact Breydon Formation clays were encountered in some of the westernmost cores.

No true brushwood peat was encountered, although further survey would be expected to reveal its presence. The boundaries between the Middle and Lower peat could not be accurately determined on the basis of the surveys undertaken to date.

The Norwich Crag was encountered at depths ranging from 15cm below ground surface in the east of the site and in excess of 165cm in the west. Sampling was not undertaken below this depth, however the depth of the Crag in the extreme west of the area surveyed would be expected to be up to 200cm below ground surface.

Whilst the Crag layers sampled did include some clay material, no "pure" clay was encountered, and typically these upper layers of the Crag contained between 50% and 75% clay, the rest being sand and gravel. Further survey would be needed to determine how the make-up of the Crag varies through the site

Discussion

The key observation made was that the extent of Sphagnum dominated communities would appear to have increased substantially since the early 1990s. It could be speculated, although more work would be required to verify this, that the development of Sphagnum 'polsters' could be accelerated by decreased pH at marsh surface, possibly due to an increased reliance on rainfall as opposed to groundwater, which would be slightly alkaline. It is likely that the progression to ombrotrophic mire and hence woodland is simply a successional change, however it is probable that the rate of this progression is to some extent influenced by the chemistry of the water irrigating the fen.

The proportion of water irrigating the fen which might be derived from the various potential sources – rainwater/groundwater and surface drainage from the 'upland' is unknown, but could be anticipated to vary depending upon the location within the fen, distance to ditches, depth of peat and presence of more or less clay in the upper layers of the Crag deposits. A further complicating factor is the presence of turbaries in some parts of the fen, which might be expected to facilitate lateral water movement through the fen. Breydon Formation clay was also noted in some areas, especially in the extreme south and west of the area surveyed, and whilst in some circumstances this might impede vertical movement of water, this part of Catfield Fen lies at the very edge of the area over which the Breydon Formation clays were deposited, and here, the discontinuous nature of the clays, their partial removal through the process of turf digging and the presence of abundant *Phragmite*s rhizomes and leaf material in the clays means that they are unlikely to provide a substantial barrier to water movement.

It has been suggested that reed growth on the site has been poor for a number of years (Peter Riches pers. comm), with reed being both reduced in stature and extent. Changes in reed distribution could potentially be due to regular summer cutting, however a reduction in the height of reed may equally result from a changed water regime, with the reedbeds being fed by water which is more nutrient poor. It could be postulated, although there is no empirical data to support this, that a change in the balance of water irrigating the site towards a more rainwater dominated system would lead to reduction in available nutrients.

Calciphilous species (e.g. *Peucedanum palustre, Carex elata, Sium latifolium, Carex lasiocarpa*) appear to be associated with the fen close to the ditches, which are understood to typically have a higher pH than the fen peat (Peter Riches pers. comm. (and to a lesser extent the 'upland margin' at South Marsh), and are, in general much less common towards the centre of marsh parcels away from the ditches. This suggests that there may be a decreasing pH gradient from the ditches into the interior of parcels. Conversely, the more acid loving species and communities, including *Sphagnum* spp., *Eriophorum angustifolium,* and *Menyanthes trifoliata*, in general, appeared more common towards the centre of marsh parcels, although these species appeared particularly abundant in Middle Marsh.

Water from the crag aquifer would be expected to percolate laterally into the fen peat and there may also be vertical movement. It has been postulated that a clay layer above the crag prevents such water movement into the fen peats; however, minimal evidence of such a layer

was found during the recent peat stratigraphy survey. Whilst the Crag layers sampled did include some clay material, no "pure" clay was encountered; typically the deposits contained up to 50% sand and gravel. Further work would be needed to determine the permeability of this material; however it can be stated with some confidence that this is unlikely to be a fully impermeable layer and hence a degree of groundwater influence upon the fen peats is therefore likely under normal circumstances.

Suggestions for further investigations

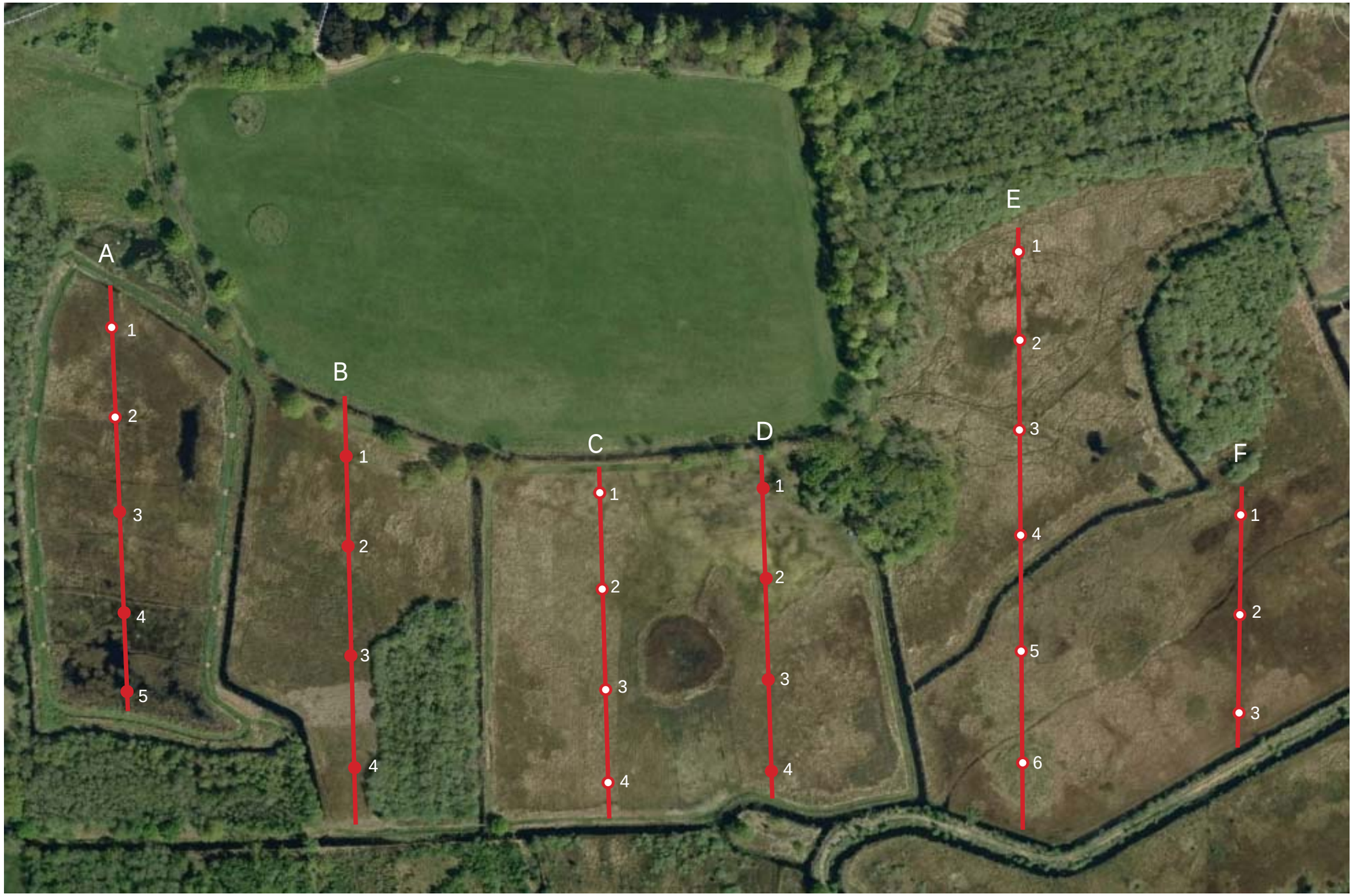
Other work to consider undertaking includes:

- Deeper bores to be undertaken in the centre of the fen parcels away from the upland margin to determine depth of peat deposits across the site and the nature of underlying geology.
- Consider bringing geologist onto project to assist in the above
- Extend the stratigraphic survey over a larger area, and decrease the separation of the boreholes to create a larger dataset and improve accuracy of the draft mapped findings.
- Re-visit the results of surveys carried out in 1991, and re-assess quadrat data using NVC
- Consider locating 1991 quadrats using the 6 figure grid-references recorded and the vegetation communities described to determine whether it might be possible to update the survey results and hence provide comparative survey data
- Carry out wider NVC survey and investigate relationship between 2013 stratigraphic core bore data and current NVC community types
- Consider distribution of acid-tolerant and calciphilous species across the fen
- Carry out pH survey of peat at various depths
- Examine pH of ditches to see if any change across site
- Determine permeability of Crag deposits through experiment

Suggestions for future site management

The site was observed to be under regular management, which is being undertaken to a high standard. On the basis of the observations made in 2013, it could be helpful to consider the following, in conjunction with advice from, and in agreement with, Natural England staff.

- consider minor changes to rotations: increase frequency of cutting to a minimum of once every 3 years.
- cut more footdrains to improve circulation of the more calcareous ditch water.
- consider re-excavating fen dykes which have terrestrialised, so as to restore this open water throughout the site. This could be done slightly offline, so that previously deposited ditch spoil is removed, and a new dyke created adjacent to that which is currently 'skimming over'.
- consider extending scrapes and shallow turf ponds. This should not, however, be undertaken in areas of 'virgin' previously uncut peat.
- Avoid cutting *Cladium* beds outside July-August period



1 Completed Core and ID

1 Core not taken

E13838 Catfield Abstraction Review

Approximate location of transect and cores

Figure 01
Scale: NTRS
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Completed Core

Confirmed Turbary

Possible Turbary

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Approximate extent of turbaries

Figure 02
Scale: NTRS
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Breydon Formation

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Postulated maximum extent of Breydon Formation

Figure 03

Scale: NTRS

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Key:

- Rootmat
- Turbary
- Humified peat
- Upper peat
- Upper clay (Breydon Formation)
- Middle peat
- Norwich Crag

Water table (approx depth encountered)

P Deposit considered likely to be permeable

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Borehole Data Transect A

Figure 04A

Scale: NTRS

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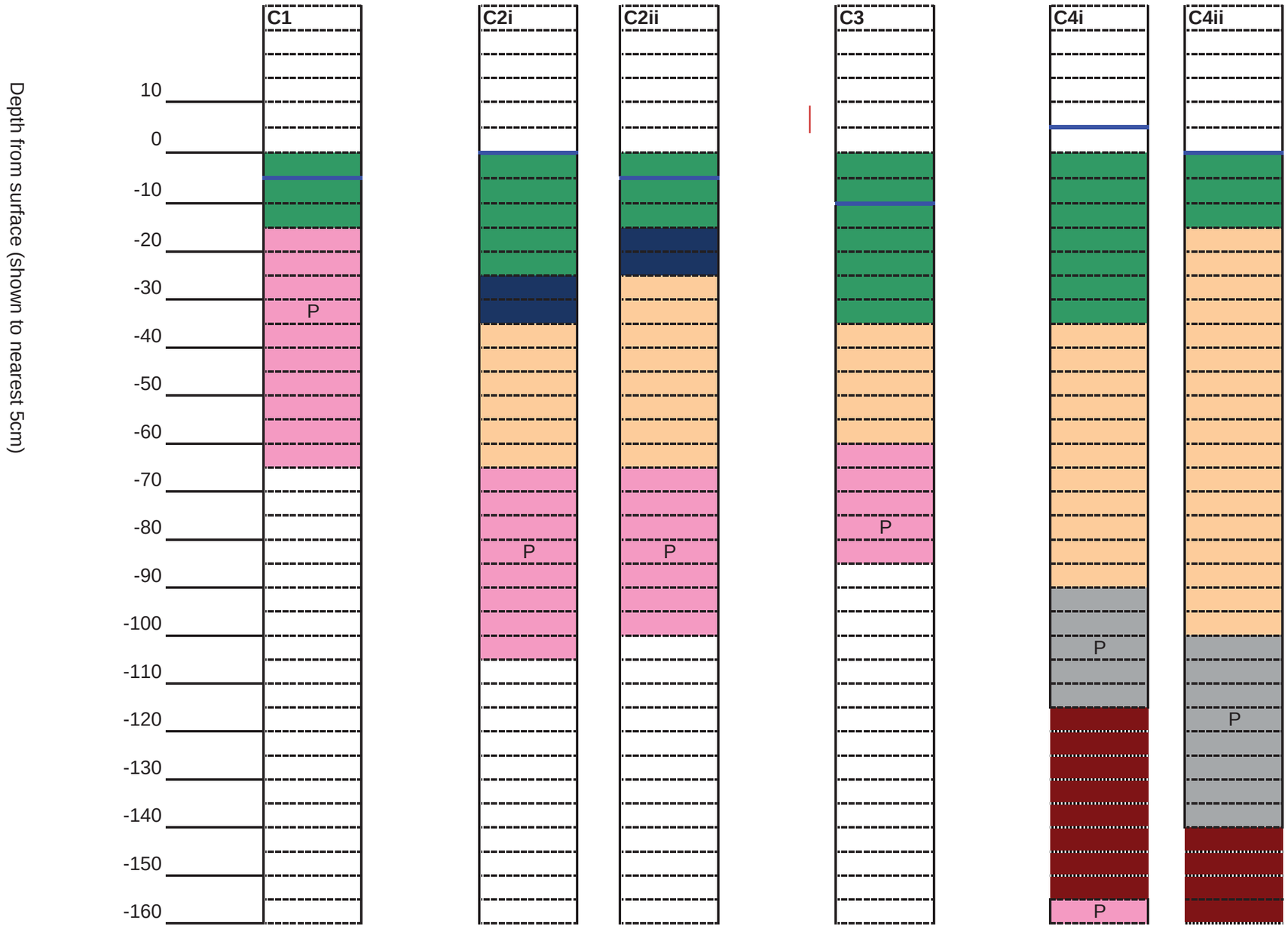

Key:

- Rootmat
- Turbary
- Humified peat
- Upper peat
- Upper clay (Breydon Formation)
- Middle peat
- Norwich Crag

Water table (approx depth encountered)

P Deposit considered likely to be permeable

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Borehole Data Transect C

Figure 04C
Scale: NTRS
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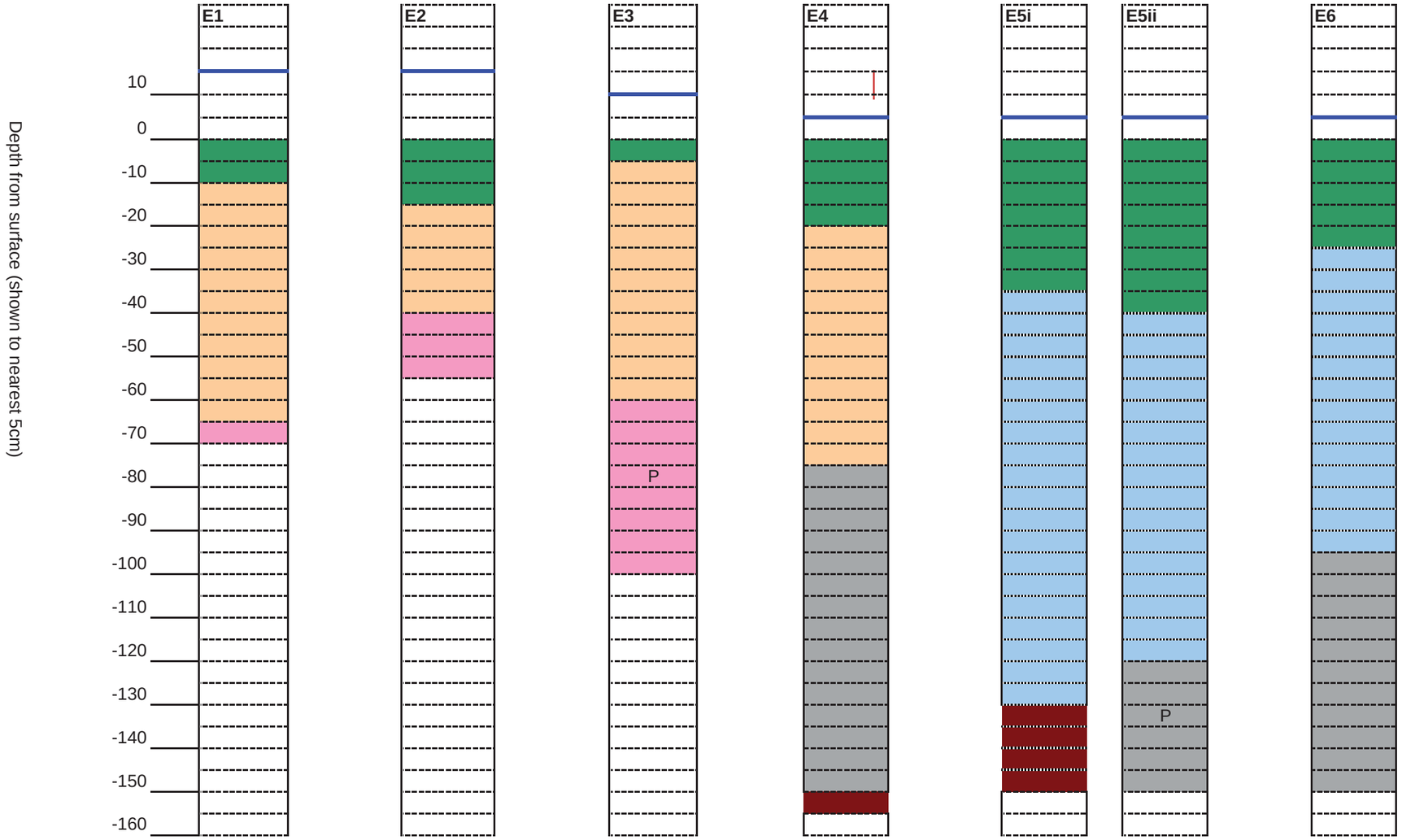

Key:

- Rootmat
- Turbary
- Humified peat
- Upper peat
- Upper clay (Breydon Formation)
- Middle peat
- Norwich Crag

Water table (approx depth encountered)

P Deposit considered likely to be permeable

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Borehole Data Transect E

Figure 04E

Scale: NTRS

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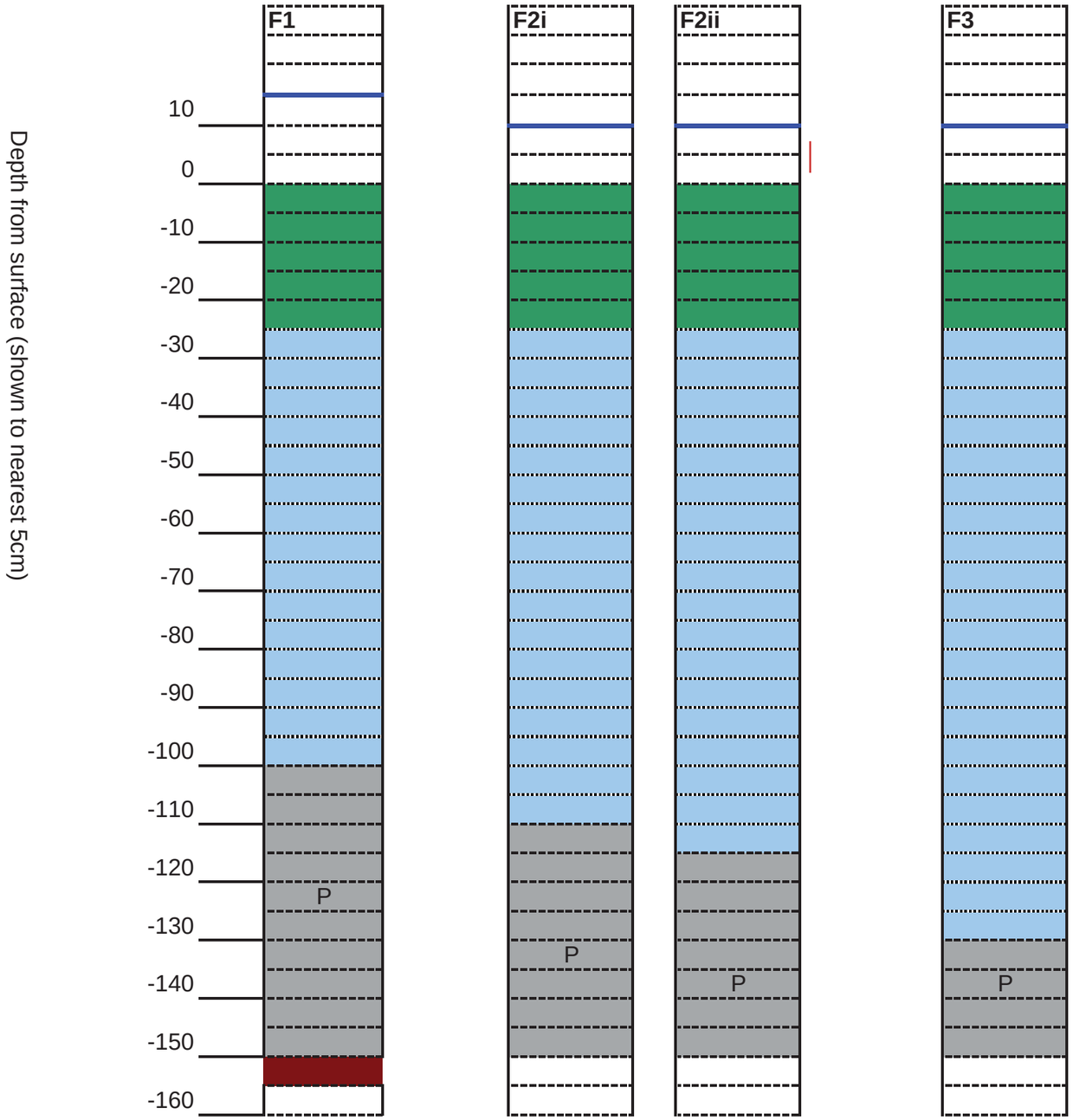

Key:

- Rootmat
- Turbary
- Humified peat
- Upper peat
- Upper clay (Breydon Formation)
- Middle peat
- Norwich Crag

- Water table (approx depth encountered)
- P Deposit considered likely to be permeable

E13838 Catfield Abstraction Review

Borehole Data Transect F

Figure 04F
Scale: NTRS
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