K Cultural Heritage

INTENTIONALLY BLANK

North

1km

500m

130,240

14,290

14,276

14,281

1,510

14,280

0 125 250 500 750 1,000 Meters

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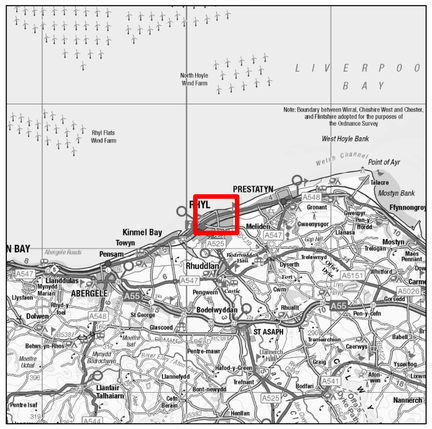
LEGEND

- Aircarft crash site
- Listed Building
- Operational Site Extent
- Permanent Land Take
- Final Construction Site
- Original Construction Site
- Conservation Area

KEY PLAN



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Cultural Heritage Appendix Figure 1

Scale: 1:4,500	Drawn	CPAT	10/10/2018
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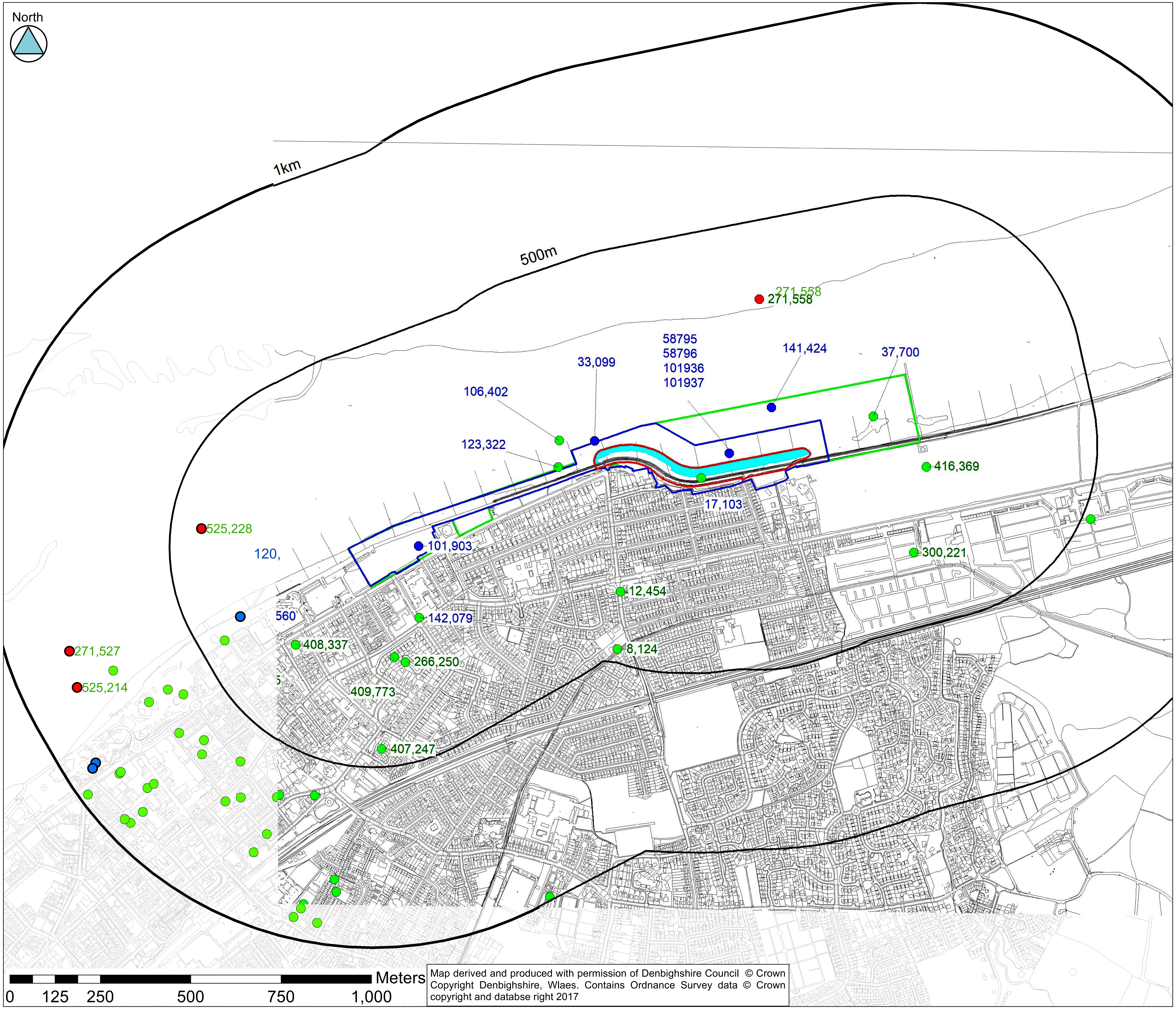
Digital File Name: 2016s5126 Environmental Statement Cultural Heritage Appendix Figure 1

Drawing Number:	Sheet No.:	Rev.:
	1 of 1	v0-3



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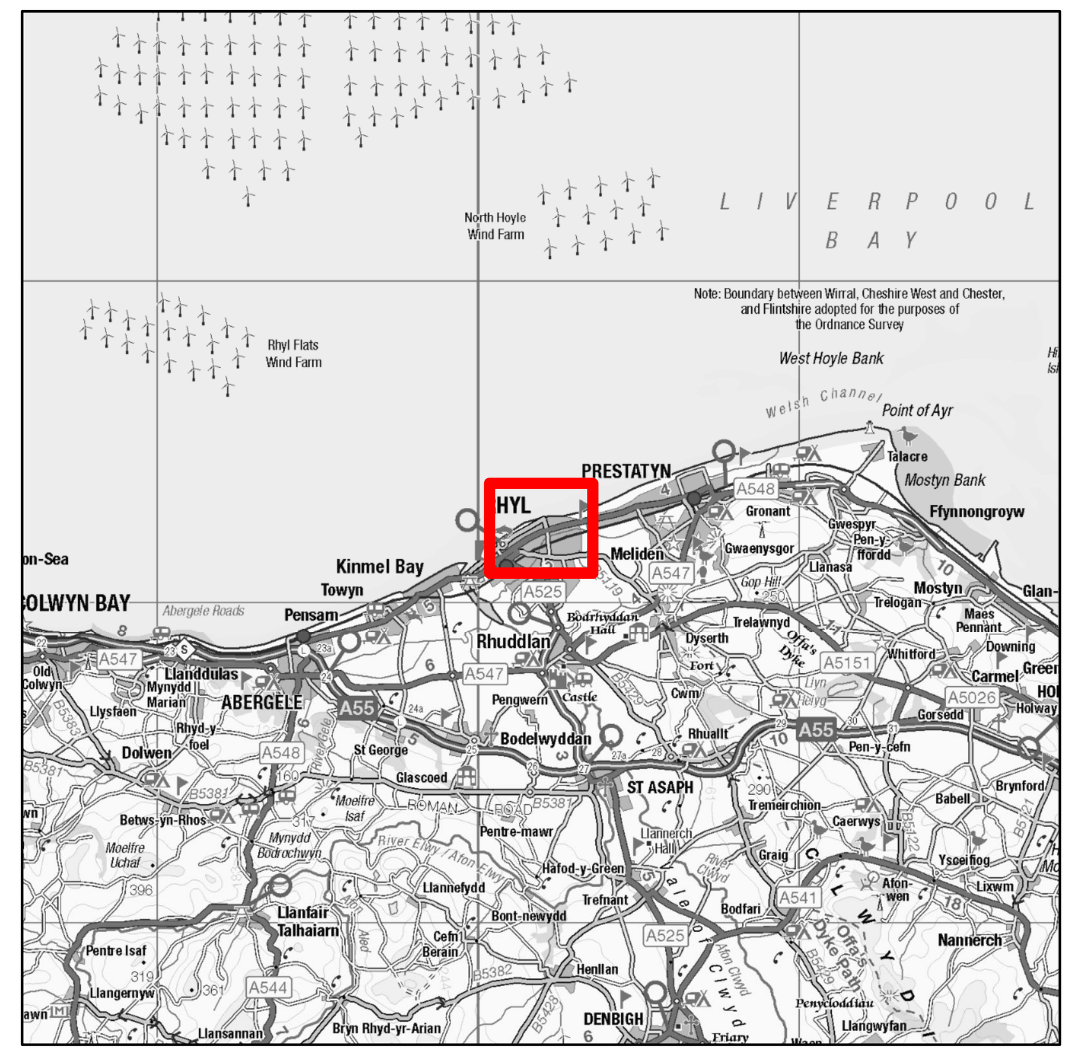
LEGEND

- Undesignated Wreck
- Undesignated Asset
- Find
  - PRN / NPRN
- Operational Site Extent
- Permanent Land Take
- Final Construction Site
- Original Construction Site

KEY PLAN



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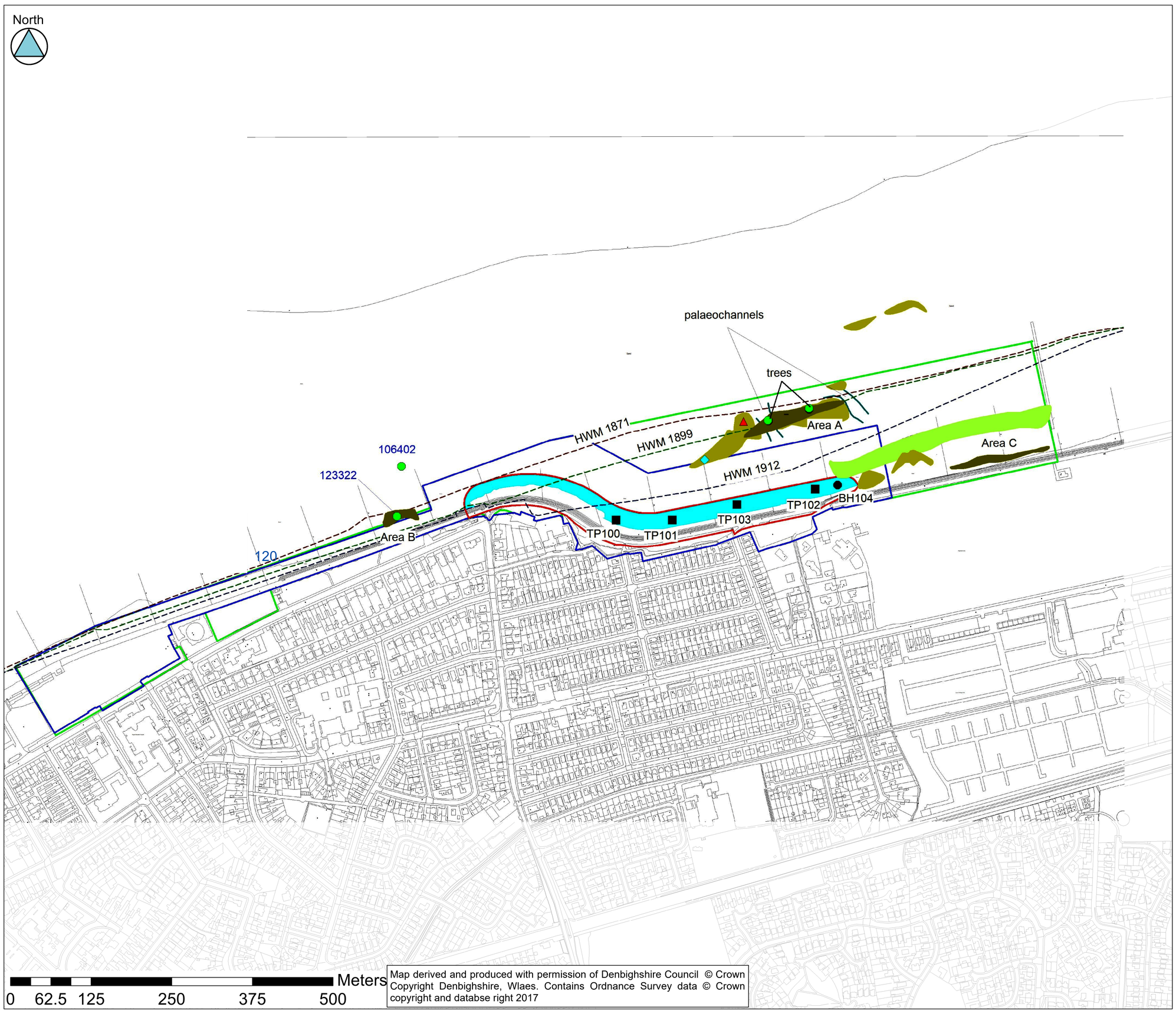
Cultural Heritage Appendix Figure 2

Scale: 1:5,000			
	Drawn	CPAT	10/10/2018
	Checked	MC	10/10/2018
	Approved		

Digital File Name: 2016s5126 Environmental Statement Cultural Heritage Appendix Figure 2

Drawing Number:	Sheet No.:	Rev.:
	1 of 1	v0-3

North

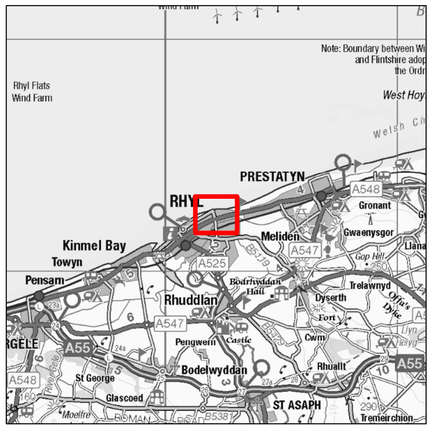


0 62.5 125 250 375 500 Meters

LEGEND

- Peat Deposit (BGS)
- Peat Deposit Exposed 2018
- Peat Deposit Exposed 2005/06
- Undesignated Asset
- Animal/Human Prints 2005/06
- Findspot 2005/06
- Test Pit
- Borehole
- Permanent Land Take
- Operational Site Extent
- Original Construction Site
- Final Construction Site

KEY PLAN



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Cultural Heritage Appendix Figure 3

Scale:			
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	Approved		

Digital File Name: 2016s5126 Environmental Statement Cultural Heritage Appendix Figure 3

Drawing Number:	Sheet No.:	Rev.:
	1 of 1	v0-3

An evaluation of the foreshore deposits at Splash Point, Rhyl

Martin R Bates and Roderick Bale

University of Wales Trinity Saint David: Lampeter

August 2018

Introduction

An evaluation was undertaken on behalf of the Clwyd-Powys Archaeological Trust (CPAT) to assess the significance and potential of foreshore deposits near Splash Point, Rhyl, Denbighshire, in connection with the East Rhyl Coastal Defence Scheme.

Background

The earliest account available to the author that documents peat and tree remains at Rhyl is recorded in the North Wales Chronicle, February 11th, 1893:

> *"The action of the tide at Rhyl within the last few days has disclosed the singular sight of an ancient forest, which, for a period of eighty years has been completely covered by the sea. The scoured portion of the beach where the remarkable sight is presented is situated opposite the Marine Drive, about a mile east of the pier. The town surveyor Mr. R. Hughes has made an accurate plan of the place, which shows about thirty trees rooted as they grew, whilst there are a number of horizontal trunks which appear to rest as they fell. Several of the trees have been proved to be of oak and elm, and the remainder appeared to be birch, alder and hazel. The stumps vary in diameter from 12 to 24 inches and are situated about 100 yards from the edge of the sandhills and are covered during high spring tides by about 10 feet of water. The scoured portion in the sands, which exposes these old roots, extends for about 550 yards in length and varies in width from 7 to 35 yards. Folk lore asserts that this is part of an old forest, the portion in question being known as "Coed Mawr y Rhyl"*

Older records are certainly implied by this report however the first scientific documentation of the peat and trees beneath the foreshore sands at Rhyl can be traced back to the early 20th century when Ashton (1920) recorded trees rooted into clay on the Rhyl foreshore. Ashton's work suggested that peat occurred at different elevations in the area and he recorded as many as 200 stumps rooted in clay on the Rhyl foreshore. He wrote:

> *"The submarine forest comes well into view on the shore at the east end of the Rhyl promenade. In August 1918 the writer counted 100 stumps rooted in clay. In October 1912 Mr Glenn counted 200 between Rhyl pier and about half way from the east end of Rhyl to the centre of Prestatyn. The belt exposed was 60-70 yards wide. This belt was also exposed in February 1893 and consists of birch and Scotch fir chiefly, and oak, hazel, elm and alder"*

Similar observations have been made since then by others including Neaverson (1936), Bibby (1940), Tooley (1978), Manley (1981, 1989) and Bell (2007). Neaverson (1936) suggested that

the trees at Rhyl are mainly oak (*Quercus* spp.), with some birch (*Betula* spp.) and nuts and twigs of hazel (*Corylus* spp.) while Bell (2007a) also suggest that alder (*Alnus*) and Willow (*Salix*) are also present. Bibby (1940) recorded plant content and pollen grains in two beds of peat; birch (*Betula* spp.) was the dominant tree with frequent oak (*Quercus* spp.), lime (*Tilia* spp.) and pine (*Pinus* spp.) trees, and evidence of frequent berries (*Rubus* spp.) and hazelnuts (*Corylus* spp.). Bibby (1940) considered the peats to be of Neolithic or Bronze Age date. In accordance with this, Tooley (1978) and Bell (2007) date the earliest peat deposits at Rhyl at 4725±65 BP.

Despite these numerous observations the nature of the deposits between Rhyl and east towards Prestatyn remain only partially understood. Whittow (1965) described four sites at Rhyl, including one at Foryd (SJ995808), where two peats (an upper and lower one) were present (the upper peat was 29 feet 6 inches below OD, with a lower peat 40 feet below OD). At the Town Hall a peat with tree remains occurred 2 feet above OD, while at Marsh Road the top of the peat was at 9 feet OD. The fourth site was poorly contexted but is probably close to the foreshore where he described an upper peat 6-7 feet below the surface and a lower peat 13-15.7 feet below the surface. Manley (1981; 1989) has also examined borehole from the Rhyl area and concluded that peat horizons represent land surfaces at two separate depths; an upper peat occurring at approximately 2m OD and an infrequent lower peat at approximately 1-2m below OD. These observations support those of Bibby (1940) who refers to an 'upper forest' and 'lower forest'; something also suggested by Neaverson (1936: 45). Further west four deep boreholes have recently been examined from either side of the river Clwyd by the author. West of the river two major peat deposits were located but where replaced by silts and sands east of the river. Figure 1 presents a simplified model for the Rhyl/Prestatyn area modified from Bell (2007b) that includes a lower and upper peat. Based on this model and Manley's 1989 study it appears likely that only the lower peat occurs in the Rhyl foreshore area. However, this remains to be verified.

Turning to the foreshore at East Rhyl where the development is to be undertaken, Bell (2007a) provides detail on the nature of the sediments expected in the area and Figure 2 is an attempt to syntheses his results with the present development. Bell provides mapped information on the distribution of peat and clay-silt outcrops in 2005/06 and these are shown with his designations B-E. He described the presence of a core fragment (A on Figure 2) embedded in the old landsurface beneath the clay-silts, animal and human prints (P) and significantly two channels he was able to infer from the presence of tilted blocks of peat. These are significant as commonly animal remains are encountered in such features. He summarises the stratigraphic sequence as the following (from the latest to the oldest):

vi) Estuarine sediments
v) Upper peat with submerged forest including oaks, deer and auroch prints
iv) Estuarine sediments with human and deer prints, possible context of Mesolithic mattock and polished axes
iii) Lower peat and submerged forest of willow, possible context of flint artefacts reported by Smith (1924)
ii) Estuarine sediments
i) Boulder Clay

Archaeological material has been collected from the foreshore and occasionally from within the sediments associated with the peat/clay silts outcropping on the beach. These finds range from a Mesolithic antler mattock (Davies, 1949; Bonsall and Smith, 1989) to a range of finds of Neolithic or Bronze Age date (Morris, 1923; Glenn, 1926; Davies, 1949; Manley, 1989; Bell, 2007a). These are summarised in Table 1. Significantly some of these finds have been made in the estuarine blue clay underlying the forest beds.

These deposits have also produced mammal remains including red deer (including a full set of unshed antlers), roe deer, ox, horse, sheep, pig, badger, fox, wolf and whale (Neaverson, 1936). Morris wrote (p151, 1923) that 'almost all the animal remains found by me were in situ in the blue clay beneath the peat. They are considerably mineralised.' Also present are the prints of a range of animal species including deer, cattle and human; again, these appear to derive from the clay-silt deposits beneath the peats.

Observations from recent geotechnical survey (including borehole BH 104), field survey and rapid assessment

Four boreholes and four test pits have been drilled as part of the geotechnical works associated with the proposed works in the foreshore area. The position of these works is shown in Figure 2 and a profile through the sequences is presented in Figure 3. One borehole was selected for the recovery of samples suitable for palaeoenvironmental examination (BH 104). Consequently, two boreholes were drilled at this location for geotechnical and archaeological purposes (Table 2, Figure 4).

In the case of the test pits and borehole 104 (geoarchaeological record, Table 2) peat was located. The peats varied in thickness and in all cases lay at or above 0m O.D. Peats were associated with clay-silt horizons that compare well with the historical records from the area. In borehole 104 (geoarch) beneath the peat channel like deposits and possible high energy shoreface deposits were recorded at the base of the sequence sample in the U4 samples.

Biological material appears preserved in the sequences with molluscs noted in various units (Table 3). Eight samples from BH 104 (geoarch) were studied from 0.30 down to 2.96m in the core. The results of the microfossil assessment can be seen in Table 3. For the most part the silts and silty sands contained iron mineral and thus appear all to be weathered; pyrite growth was also responsible, it is felt, for the general dearth of microfossils. Microfossils were recovered in the sample from 2.00-2.02m, where a small population of the brackish morphotype of the calcareous foraminiferal genus *Ammonia* was found (colour-coded grey) indicative of brackish mudflat environments. In the two peaty clay samples (either side of the main peat unit) a small number of agglutinating foraminifera (colour-coded light green), all belonging to *Jadammina macrescens,* were observed with some difficulty within the organic residue. These indicate, at least, that mid-high saltmarsh environments existed before and after the formation of the peat. The uppermost sample (0.30-0.32m) was completely barren (probably decalcified due to weathering) and the two sandy samples at the base were, likewise barren. Nevertheless, it is felt the sequence is probably wholly brackish and estuarine.

The sample from 2.30-2.32m was curious. There was virtually no residue left after processing and what remained was confined to calcareous tubes containing plant rootlets. These are usually referred to as rhizoliths and indicate the drying out of an interface, possibly due to channel migration nearby or climatic activity.

Two samples were submitted for radiocarbon dating (Table 4); one wood fragment (slow grown oak (*Quercus* sp.) that contains around 110 rings in a 5cm radii, with an average ring width of 0.43mm) from TP 103 (at +0.42m O.D.) and a 2cm slice of reed peat from BH 104 (geoarch) (at +1.07/1.09m O.D.). The results of the dating are presented in Table 4. The outer edge of the wood sample, while not retaining bark or sapwood, has a natural curve, suggesting that only the sapwood, and a few heartwood rings have been lost to decay. Therefore, the radiocarbon date obtained from the wood is likely to represent an approximate date at which the parent tree died. The date from the wood is 7990 ± 30 BP which calibrates to 7050 - 6800 cal BC (8999 - 8749 cal BP) (93.8%) and 6790 – 6776 cal BC (8739 – 8725 cal BP (1.6%). The sample of reed peat from BH 104 (geoarch) dated to 6160 ± 30 BP which calibrates to 5215 – 5005 cal BC (7165 – 6955 cal BP) (95%).

A recent field survey identified three areas where peat deposits were exposed on the foreshore, the most significant of which lay within a runnel some 125m below the HWM and included the remains of two fallen trees. Other, presumed later deposits, included an area west of Splash Point which contained a possible fish trap, and an area at the eastern end of the construction site which contained a mass of root.

Discussion

The evidence from the geotechnical investigation and the observations made on the core samples recovered indicate the following:

1. The stratigraphy from the boreholes/test pits has similarities with that provided by Bell (2007a) but also differs from that in detail. The proposed works have the potential to impact on important archaeological and palaeoenvironmental remains associated with both the peat and the estuarine clays.
2. The potential impacts within the construction site fall within a complex area (Figure 2) in which not only is a submerged forest present, but also channels cutting through the forest (and tidal mudflat/saltmarsh sediments above and below the forest) as well as possible storm beach environments resting on the till topographic template. Consequently, careful consideration needs to be given to this complex terrain where sediments are likely to vary laterally rapidly, and the archaeological context of material will change in response to this variation.
3. Previous work indicates that archaeological and biological material is associated not only with the peats but also the minerogenic sediments above and below the peat.
4. These deposits all appear to lie within 2.5 to 3m of the surface of the Holocene sediments, they are only buried by shallow sequences and will be vulnerable to impact from construction activity.
5. To date only minimal analysis of sediments and sequences have taken place in this area. Microfossils indicate saltmarsh and mudflat environments are associated with the sediments above and below the peats.

6. Dating of the peat provides a Mesolithic age for the peat and associated tree remains recovered to date. There is a considerable age difference between the two samples and consequently the sediments here appear to span much of the Late Mesolithic period.
7. The deposits associated with the submerged forest are considered to be of High archaeological value.
8. The deposits containing a possible fish trap are considered to be of Medium archaeological value.
9. Deposits at the eastern end of the construction site are considered to be of High value.

Proposed mitigation

The results from mitigation works undertaken during a similar scheme at Borth (Meek 2012) have indicated the need for a broad spectrum approach in order to recover sufficient data to adequately mitigate the predicted impacts on important buried deposits. In the case of Borth it was demonstrated that the conditions under which a watching brief was conducted were inappropriate for the recovery of sufficient information to ensure the preservation by record of any deposits which were damaged or lost.

It is suggested that in mitigation a phased investigation should be undertaken at the site with the objective of creating an interpretation of the archaeology, vegetation and landscape evolution of the site through time. The aims of the works should then be:

- To record and understand the evidence for the past environmental conditions of the site
- To record and understand the evidence for human activity at the site
- To collect samples to assess the potential for off-site analysis/assessment
- To interpret archaeological site formation processes
- To report on the findings of the surveys
- To archive and disseminate the results of the work

To achieve this, it is suggested that the fieldworks should, where possible, be completed in advance of construction taking place and that a watching brief takes place during construction. The phased investigation should be broken down into the following parts:

1. Walkover survey and trial augering where exposures of sediment permit such works. Such a rapid survey, including recording and sampling after any storms would set some baseline expectations for the nature of sequences likely to be encountered in subsequent phases.
2. Geophysical survey to map out buried topography, position of potential palaeochannels. This would be a two-stage process that would include Electromagnetic survey at low tide to map the geoelectrical differences across the beach (these would reflect the nature of the underlying geology) and a shallow seismic survey at high tide to model the distribution of seismic units across the site. The outcome of these surveys would be a series of topographic interpretations and subsequent targets for test pitting/drilling. This data could also be used to assess the

potential of the area to contain hitherto unknown wrecks and other structures buried beneath the modern beach sands.

3. Test pitting/boreholes to recover samples from the buried sequences for palaeoenvironmental analysis. These works would also examine the subsurface for archaeological and/or biological remains.
4. Watching brief.
5. Assessment and analysis of recovered materials.

Any exposed submerged forest tree stumps/ trunks or wooden structural remains within the impacted areas should be recorded in situ, prior to construction, noting location, stratigraphic information and size. Samples for dendrochronological dating and species identification should then be taken from stumps/ trunks/wooden structure. All recording and sampling must be conducted by appropriately qualified staff.

Any trees or wooden structural remains encountered during construction and excavation works should likewise be recorded in situ, with some hand excavation around remains necessary to facilitate sampling and recording, again by appropriately qualified archaeological staff. Dendrochronological samples will be assessed for suitability for dating. Information on species type and age of recovered trees/timbers will be determined. Where cross matching with existing tree ring data cannot be determined, it may be necessary to undertake radio-carbon dating of some of the material to provide dating evidence.

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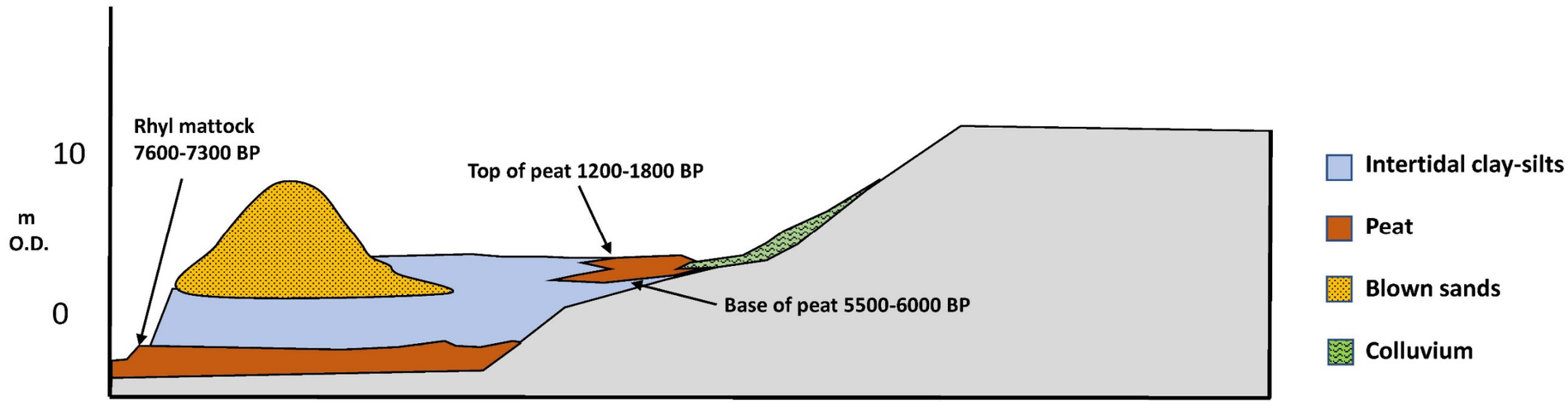

Figure 1. Schematic model for the Rhyl/Prestatyn area (modified from Bell, 2007b).

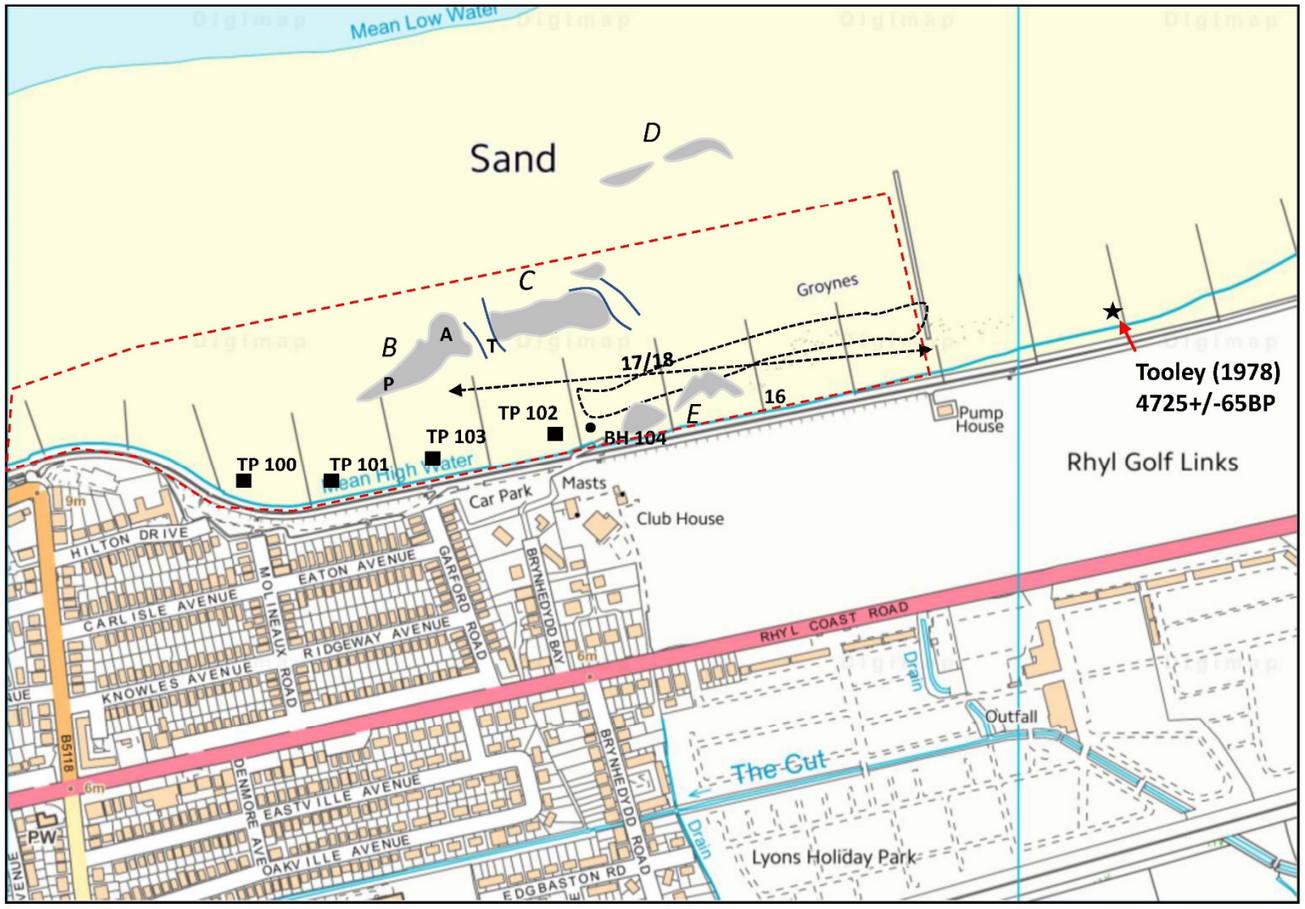

Figure 2. Site location plan for study area including data from Bell (2007a/b).

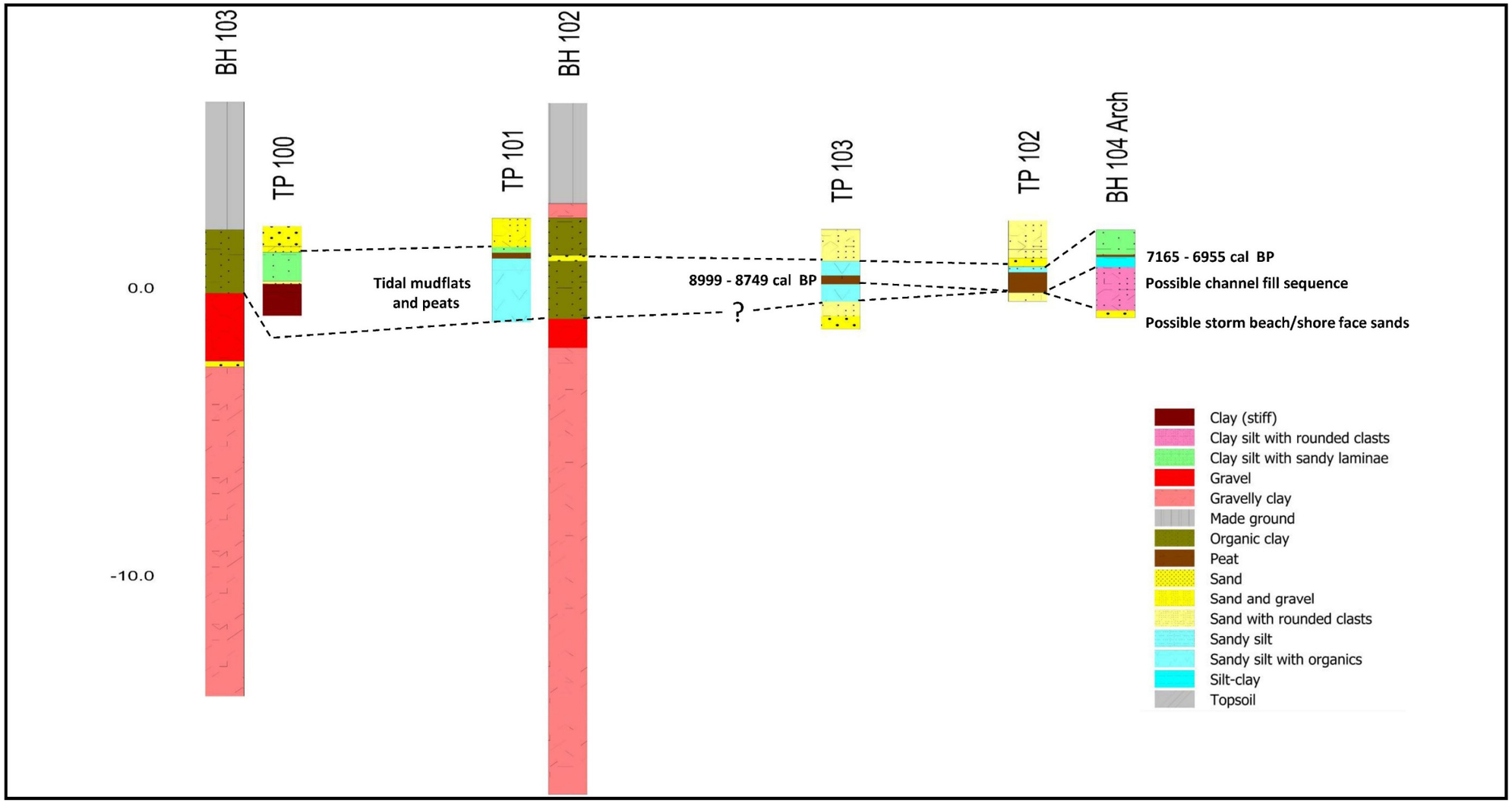

Figure 3. Lithological profiles from boreholes and test pits in study area.

Figure 4. U4 samples from BH 104 (geoarch) cut and cleaned prior to sampling.

Table 1. Archaeological and biological finds from the Splash Point area, Rhyl.

Find	Location	Geomorphological context	Date	Other information	Reference
Antler mattock/arrow straightener	Splash Point	Blue clay where erosion had removed the submerged forest	6560+/-80 B.P.	Red deer antler	Davies, 1949 Bonsall and Smith, 1989
Shed antler	Rhyl foreshore	Foreshore		Red deer antler that appears to have been cut off and the heavy end used as a mallet	Morris, 1923
Flint debitage	Rhyl foreshore	Lower Peat			Burrow, 2003
Two polished stone axes	Beach at Rhyl	1920/21 find was 15cm below peat in estuarine clay. Second from 1926 had blue clay adhering to it so probably comes from estuarine clay.	Neolithic	1926 find was made of Graig Llwyd stone.	Glenn, 1926
Polished stone axe	Rhyddlan foreshore (Rhyl)	Foreshore?		Find was made of Graig Llwyd stone.	Davies, 1949
Human and animal prints	Rhyl foreshore	In estuarine silts below main peat body		Deer, auroch and human prints noted.	Bell, 2007
Core fragment	SJ 02431 82542	Embedded in old landsurface developed on head		Material is Gronant chert	
Shell with circular hole	Rhyl foreshore	Washed out of estuarine clay		Thick upper valve of *Ostrea edulis*.	Glenn, 1926
Various	Rhyl foreshore	Mostly surface finds mixed with clasts of peat and clay-silts		Bronze chisel and spearhead, three pebbles with hour-glass perforations, two perforated stone? net-sinkers	Morris, 1923 Glenn, 1926 Davies, 1949
Animal bones	Rhyl foreshore	Submerged landsurface			Burrow, 2003
Antler fragments, limb bones and teeth	Rhyl foreshore	Foreshore		Red deer (*Cervus elaphus*)	Morris, 1923
Limb bones	Rhyl foreshore	Foreshore		Roe deer (*Cervus capreolus*)	Morris, 1923
Skull with horn cores, limb bones and teeth	Rhyl foreshore	Foreshore		Small ox (*Bos longifrons*)	Morris, 1923
Teeth and limb bones	Rhyl foreshore	Foreshore		Horse (*Equus caballus*)	Morris, 1923
Metatarsal and jaws	Rhyl foreshore	Foreshore		Sheep (*Ovis aries*)	Morris, 1923
Teeth and limb bones	Rhyl foreshore	Foreshore		Pig (*Sus scrofa*)	Morris, 1923
Ribs (broken or cut)	Rhyl foreshore	Foreshore		Whale	Morris, 1923
Lower jaw	Rhyl foreshore	Foreshore		Wolf (*Canis lupus*)	Morris, 1923
Antlers with skull fragments	Rhyl foreshore	In estuarine clay 3-4 feet below the peat beds		Red deer (*Cervus elaphus*), not shed	Morris, 1923

Table 2. Comparison between geotechnical log and geoarchaeological log for BH 104.

BH 104 (geotech record)		**BH 104 (geoarch record)**		**Interpretation (based on geoarch borehole)**
0.00 – 0.10	Light brown gravelly fine to coarse sand with a high cobble content. Gravel is subangular to rounded fine to coarse including siltstone, standstone, quartz, feldspar and bivalve shell fragments.	0.00 – 0.86	Grey clay-silt with fine sand laminations. Laminae are discontinuous, wavy and sub-parallel, 1-3mm thick. Occasional vertical reed root traces. Soft and pliable.	Tidal or inter-tidal mudflats. (Microfossils from 0.83-0.85m suggest mid to high saltmarsh)
0.10 – 2.60	Soft grey occasionally mottle orange slightly peat silty clay. Below 2.0m firm with occasional bands (up to 100mm) thick of soft fibrous dark brown peat. Below 2.5m greyish brown.	0.86 – 0.94	Black humified peat with brown reed fragments (horizontally bedded). Moderately firm and compact.	Supra tidal reed swamp.
2.60 – 3.90	Brown slightly gravelly fine to coarse sand with some clayey bands. Gravel is subrounded medium to coarse including siltstone	0.94 – 1.03	Dark grey clay-silt becoming paler grey colour with depth. Structureless and massive.	Tidal or inter-tidal mudflats. (Microfossils from 0.83-0.85m suggest mid to high saltmarsh)
		1.03 – 1.30	Pale grey clay-silt.	Tidal or inter-tidal mudflats.
		1.30 – 1.55	Grey clay-silts with some rounded beach pebbles (1->3cm). Occasional shell fragments.	Tidal channel fill?
		1.55 – 2.60	Pale grey to greyish brown clay-silt with occasional large rounded beach cobbles. Moderately firm and compact. Occasional shell fragments.	Tidal channel fill? (Microfossils from 2.00-2.02m suggest brackish mudflats)
		2.60 – 2.80	Mid grey clay with sand and cobbles of beach pebbles. Mixed and structureless appearance. Shell fragments present.	Channel fill?
		2.80 – 3.05	Very coarse sand with occasional rounded clasts and shell fragments.	Shore face sands, intertidal sand flats.

Table 3. Rapid assessment of core material.

Depth in core	0.30-0.32m	0.83-0.85m	0.95-0.97m	1.60-1.62m	2.00-2.02m	2.30-2.32m	2.70-2.72m	2.94-2.06m
plant debris + seeds	**x**	**x**	**x**	**x**	**x**	**x**	**x**	**x**
iron minerals	**x**			**x**	**x**		**x**	**x**
brackish foraminifera (agglutes) **(calcareous)**		**x**	**x**		**x**			
rhizoliths						**x**		
sediment	*silty clay*	*peaty-clay*		*silty clay*		*clay*	*silty-sand*	
Ecology	***Mudflats (weathered)***	***Mid-high saltmarsh***		***Brackish mudflats (weathered)***		***?Semi-terrestrial; drying up***	***Estuarine sands***	

Contained material is recorded on a presence(x) / absence basis

Table 4. Radiocarbon dates from TP 103 and BH 104 (geoarch).

	Sample depth (bgl)	**Sample depth O.D.**	**Sample type**	**Laboratory number**	**Conventional radiocarbon age (yr. BP)**	**Calibrated age range (BC) at 95% probability**
TP 103	1.60m	+0.42m	Wood	Beta-502087	7990 ± 30 BP	(93.8%) 7050 - 6800 cal BC (8999 - 8749 cal BP) (1.6%) 6790 - 6776 cal BC (8739 - 8725 cal BP)
BH 104 (geoarch)	0.92-0.94m	+1.09 to +1.07m	Reed peat	Beta-502628	6160 ± 30 BP	(95%) 5215 – 5005 cal BC (7165 – 6955 cal BP)

CPAT INV 898-1

East Rhyl Coastal Defence Project

HERITAGE MITIGATION BRIEF

Produced by

Clwyd-Powys Archaeological Trust

On behalf of

JBA Consulting

YMDDIRIEDOLAETH ARCHAEOLEGOL CLWYD-POWYS

CLWYD-POWYS ARCHAEOLOGICAL TRUST

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1 Introduction

1.1. The Clwyd-Powys Archaeological Trust (CPAT) have prepared this brief on behalf of JBA Consulting, detailing the requirements for a programme of mitigation works in connection with the East Rhyl Coastal Defence Project. JBA Consulting has been commissioned by Balfour Beatty, on behalf of Denbighshire County Council (DCC), to develop a scheme for improving the coastal defences at East Rhyl in Denbighshire

1.2. Rhyl is a seaside resort town on the southernmost coastline of the estuary of the Liverpool Bay/Bae Lerpwl. The town has historically been protected from coastal flooding by a range of hard defence structures constructed in the 1950s. The coastal defences in the east of the town are now exceeding acceptable performance standards. At East Rhyl, the existing defences have overtopped in recent years, causing significant damage and disruption residential properties and businesses.

1.3. In 2013 deep flooding of 130 residential properties led to 400 people being evacuated from their homes with some having to be rescued by boat. Since then flood modelling has shown that this risk of this happening again is set to increase with climate change projections for increased sea level rise and storminess. The effectiveness of the existing defences will therefore continue to reduce. Action is needed to protect East Rhyl now and in the future to sustain the local community and to continue to promote Rhyl as a tourist destination, which is important to the local economy.

1.4. The East Rhyl Coastal Defence Scheme has been designed to protect up to 472 properties from flooding caused by wave overtopping of the existing seawall during severe storm events. The new defences would provide protection of these properties over the next century from a storm event of a magnitude only expected to occur once in a two hundred year period (a storm with a 0.5% probability of occurring each year).

1.5. An Environmental Impact Assessment was conducted by CPAT in preparation for the Cultural Heritage chapter of the Environmental Statement for the flood defence scheme, which was finalised in October 2018.

1.6. The ES identified a series of archaeologically and palaeoenvironmentally significant deposits within the construction site, representing sedimentation of tidal flats (PRN 17103) and resulting from fluctuations in and the gradual rise of sea levels after the last glaciation. Exposures of peat and the remains of a submerged forest on the Rhyl foreshore have been documented since the late 19th century and in 1912 around 200 tree stumps were observed.

1.7. Archaeological material has been collected from the foreshore and occasionally from within the sediments associated with the peat/clay silts outcropping on the beach. These finds range from a Mesolithic antler mattock to a range of finds of Neolithic or Bronze Age date. Observations made in 2005/06 included the identification of animal and human footprint, as well as a flint core fragment, embedded in the old landsurface beneath deposits of clay-silt. Significantly, two palaeochannels were also noted which have the potential to contain important deposits which could include animal remains.

2 Mitigation

2.1. The construction site contains significant, high value deposits associated with the submerged landscape (PRN 17103) which are largely buried beneath beach sand, although elements are exposed periodically following major storms.

2.2. The design of the rock armour and associated construction works is such that it will not be possible to mitigate through design alone. It has been recognised that the conditions under which a watching brief would be conducted are unlikely to be appropriate for the recovery of sufficient information to ensure the preservation by record of deposits which would be damaged or lost as a result of the scheme. While a watching brief during construction remains valid mitigation to reduce the adverse effects through the identification and recording of significant features and deposits, as well as the recovery of artefacts, the potential extent of impacts is such that a broader spectrum of mitigation measures is required to offset the physical loss of deposits and the evidence for human activity, faunal remains and palaeoenvironmental evidence which they contain.

2.3. The ES therefore presented a phased programme of mitigation with the objective of creating an interpretation of the archaeology, vegetation and landscape evolution of the site through time, thus offsetting the physical impacts and reducing the residual effects. The aims of the works will then be:

- to record and understand the evidence for the past environmental conditions of the site;
- to record and understand the evidence for human activity at the site;
- to collect samples to assess the potential for off-site analysis/assessment;
- to interpret archaeological site formation processes;
- to report on the findings of the surveys;
- to archive and disseminate the results of the work.

2.4. The phased investigation will include the following:

Phase 1 mitigation – between contract award and start of site works

1. Walkover survey and trial augering where exposures of sediment permit such works.
2. Any submerged forest tree stumps/trunks, or wooden structural remains, which are currently exposed within or immediately adjacent to the construction site will be recorded in situ noting location, stratigraphic information, dimensions and descriptive record.
3. Geophysical survey to map out buried topography and identify the position of potential palaeochannels within the construction site.
4. Test pitting/boreholes to recover samples from the buried sequences for palaeoenvironmental analysis within the construction site.
5. Full excavation and recording of timber structures and deposits within Area B to ensure their preservation by record.

Phase 2 mitigation – during construction phase

6. Watching brief during initial groundworks associated with the following: construction of beach access ramp; excavation of beach sand; construction of rock armour; construction of beach access steps. The watching brief will also monitor the wider foreshore throughout the construction phase to identify anything revealed as a result of turbulent flows around stockpiled materials. The watching brief will not be required during the actual construction of the rock armour. Access ramp, beach steps etc.
7. Survey, recording and sampling following any exposure of significant deposits as a result of storms for the duration of the project.

Phase 3 mitigation – on completion of phases 1-2 mitigation

8. Assessment and analysis of recovered materials.
9. Dendrochronological samples will be assessed for suitability for dating and the species type and age of the trees/timbers will be determined.
10. Production of interim report

3 Standard and Guidance

3.1. The mitigation works will be conducted according to the following guidance issued by the Chartered Institute for Archaeologists' (CIfA):

- *Code of Conduct (2014).*
- *Code of Approved Practice for the Regulation of Contractual Arrangements in Field Archaeology (2014).*
- *Standard and Guidance for Historic Environment Desk-Based Assessment (2017).*
- S*tandard and Guidance for Archaeological Field Evaluation (2014).*
- S*tandard and Guidance for Archaeological Excavation (2014).*
- *Standard and Guidance for the Collection, Documentation, Conservation and Research of Archaeological Materials (2014).*
- S*tandard and Guidance for the Creation, Compilation, Transfer and Deposition of Archaeological Archives (2014).*
- *Standard and Guidance for an Archaeological Watching Brief (2014).*

4 Methodology

Recording following storm exposures

4.1. Should any significant deposits be exposed within the construction site as a result of storms a programme of rapid survey, recording and sampling should be undertaken by an appropriately qualified specialist. Discoveries must be located accurately by DGPS, with recording comprising a written description, detailed measurements and a photographic record.

Walkover survey

4.2. A walkover survey should be conducted by an appropriately qualified specialist for the whole of the construction site, which should also include a limited programme of trial augering where exposures of sediment permit such works. This rapid survey

would set some baseline expectations for the nature of sequences likely to be encountered in subsequent phases.

4.3. Hand augering should be undertaken using a gouge auger where possible and the sediment sequence recorded on pro-forma sheets. Small sub-samples should be taken if required, although it is not the purpose of this exercise to recover samples for assessment and analysis (see 4.8 below). All auger holes must be surveyed by DGPS.

Recording and sampling of exposed trees

4.4. Any submerged forest tree stumps/trunks, or wooden structural remains which are currently exposed within or immediately adjacent to the construction area should be recorded in situ, prior to the commencement of construction groundworks, noting location, stratigraphic information, dimensions and descriptive record. Samples should be taken for dendrochronological dating and species identification. All recording and sampling must be conducted by an appropriately qualified specialist.

Geophysical survey

4.5. A geophysical survey should conducted by an appropriately qualified specialist for the whole of the construction site to map out buried topography and identify the position of potential palaeochannels. This would be a two-stage process, comprising electromagnetic survey at low tide to map the geoelectrical differences across the beach (these would reflect the nature of the underlying geology) and a shallow seismic survey at high tide to model the distribution of seismic units across the site. The outcome of these surveys would be a series of topographic interpretations and subsequent targets for drilling and subsequently test pitting.

4.6. The electromagnetic survey should be undertaken by a CMD Explorer in order to assess ground conductivity and of inphase (susceptibility) at multi depths down to 6m. This would be achieved by walking a series of transect lines parallel and perpendicular to the sea front at 25m spacings. Measurements must be made and tied into the National Grid through GPS.

4.7. The marine seismic survey would be undertaken at high tide utilising a shallow survey craft suitable to cover the full site area, subject to any restrictions imposed by the presence of groynes. A parametric sub-bottom profile sonar (Tritech) system should be used. These type of sonar are ideally suited to survey in very shallow water and can be deployed on small research vessel or vessels of opportunity. The sonar should be deployed together with a motion reference unit and GNSS navigation equipment to be able to map sub-bottom layers to better than 10cm resolution vertically. The sonar should be deployed in a grid survey pattern with survey lines oriented both parallel and perpendicular to the beach. Data must be recorded and stored in industry standard SEGY format for uploading to interpretation programme (SonarWiz) and picking of sub-surface horizons. Line track horizons would then be interpolated to produce buried surfaces.

Test pits/boreholes

4.8. The results of the walkover survey and geophysical survey must be used by an appropriately qualified specialist to identify the most suitable areas within which to conduct a programme of boreholes and test pits to recover samples from the buried sequences for palaeoenvironmental analysis. These works would also examine the subsurface for archaeological and/or biological remains.

4.9. Boreholes should be drilled using a commercially contracted Terrier drill rig for the recovery of sleeved core samples. All boreholes must be surveyed by DGPS. The number of boreholes would be determined following the geophysical survey and an appreciation of the apparent complexity of the site, but it is not anticipated that this will exceed 15 boreholes. Borehole drilling must be overseen by an appropriately qualified specialist.

4.10. Borehole cores must be cut, photographed and recorded at an appropriate specialist laboratory and a stratigraphic profile should be constructed from the sequences. Cores must be wrapped in cling film and stored pending assessment and analysis. The results of the borehole investigation will inform the location of test pits (alongside the geophysical survey data).

4.11. Test pits should be excavated by machine, using a toothless bucket. Test pits must be located to sample the following: areas in which peats are present; edges of any identified channels; mid channel positions; and areas of the site where dry land might have existed in the past (i.e. where peat/tidal deposits are absent). The exact number of these test pits remains to be determined following the geophysics and drilling but up to 12 test pits might be required.

4.12. Test pits should be excavated initially to around 1m depth in order to allow access to the sequences for sampling and recording. Below c.1m depth recording should be from the trench side only with spits of 0.2m depth taken individually and spoil from each spit placed in sequence away from the trench edge to allow recording and sorting.

4.13. Full records must be made for each test pit, including representative profiles, sampling logs and sieved records. All test pits must be surveyed in by DGPS.

Watching brief

- A watching brief will be conducted by an appropriate archaeological contractor to include the following:
- Groundworks for the construction of beach access ramp
- Groundworks for the excavation of beach sand
- Groundworks for the construction of rock armour
- Groundworks for the construction of beach access steps
- Monitoring of the wider foreshore throughout the construction phase to identify anything revealed as a result of turbulent flows around stockpiled materials.

4.14. Sufficient time must be allowed for an appropriate level of investigation, recording and sample retrieval where significant deposits or features are revealed. Any significant discoveries to be demarcated by temporary barrier fencing until

investigations are completed. The implementation of the watching brief will, however, be dependent on the construction programme and methods, the weather, tides and health and safety considerations. The use of temporary shoring and a pump should be considered where appropriate and practicable, although confined spaces working may not be possible on the grounds of health and safety given the high water table on the beach, high instability of exposures and the tidal exposure of the site.

4.15. Any trees or wooden structural remains encountered during the construction phase should be recorded in situ, with some hand excavation around the remains, sufficient to facilitate sampling and recording by, or with the advice of an appropriately qualified specialist. The implementation of the recording would be subject to the same health and safety constraints as those during the watching brief.

4.16. The investigation and recording of any features or deposits must be undertaken by hand using the conventional techniques for archaeological excavation:

- Where features of archaeological interest are identified during the ground works they will be systematically investigated by hand with sufficient work being undertaken to determine their date, character and function, using the conventional techniques for archaeological excavation and in accordance with CIfA Standard and Guidance.
- All features will be located using DGPS.
- Contexts to be recorded on individual record forms, using a continuous numbering system, and be drawn and photographed as appropriate.
- Plans to be drawn on permatrace to a scale of 1:10, 1:20 or 1:50, as appropriate.
- All photography to be taken using a digital SLR camera with a minimum resolution of 12 mega pixels, including a metric scale in each view, with views logged in a photographic register.
- Digital records created as part of the project should comply with specific data standards.
- In the event of human burials being discovered the Ministry of Justice must be informed. The remains will initially be left *in situ*, and if removal is required, a MoJ licences will be applied for under the Burial Act 1857.
- In the event of finding any artefacts covered by the provisions of the Treasures Act 1996, the appropriate procedures under this legislation must be followed.

4.17. All artefacts and environmental samples must be treated in a manner appropriate to their composition and a sampling strategy will be developed as appropriate:

- All stratified finds to be collected by context, or where appropriate, individually recorded in three dimensions. Unstratified finds will only be collected where they contribute significantly to the project objectives or are of particular intrinsic interest.
- All finds and samples must be collected, processed, sorted, quantified, recorded, labelled, packed, stored, marked, assessed, analysed and conserved in a manner appropriate to their composition and in line with appropriate guidance.

- Arrangements must be made to assess and study any artefacts, assemblages and environment samples.
- Any artefacts recovered during the watching brief must be deposited with an appropriate museum, subject to the permission of the client.

Assessment and analysis of recovered materials.

4.18. Dendrochronological samples must be assessed by an appropriately qualified specialist for suitability for dating and the species type and age of the trees/timbers will be determined. Where cross-matching with existing tree ring data cannot be determined, it may be necessary to undertake radio-carbon dating of some of the material to provide dating evidence.

Interim report, archive assessment and dissemination

4.19. An interim report should be prepared on the results from the mitigation work, containing sections to include:

- Non-technical summary
- Introduction
- Site location
- Topography and Geology
- Archaeological Background
- Geophysical survey
- Palaeoenvironmental sampling
- Watching brief
- Artefacts
- Specialist assessment
- Dating
- Conclusions
- References
- Appropriate appendices on archives and finds

4.20. The report must conform to the minimum requirements set out in the *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)*.

4.21. All submitted reports will need to include the equivalent of a non-technical summary of the Archaeological Event at the front of the report combined with short summaries of the principal Historic Assets recorded during the event. **These requirements are mandatory**. Examples and further technical information are given in the guidance, or contact the HER Officer Gary Duckers gary.duckers@cpat.org.uk for more information.

4.22. Copies of the report must be deposited with the client, the regional Historic Environment Record and the National Monuments Record, following approval by the regional archaeological curator. A short report should also be published in *Archaeology in Wales*.

4.23. Following the completion of fieldwork the site archive must be assessed to determine the potential of the data to contribute to archaeological knowledge and to identify any further study necessary. This should be completed within three months of the conclusion of all on site fieldwork. The results of the assessment must be submitted to the curator for approval, as follows:

- An interim report of the excavation results.
- A full description of the site archive.
- An assessment of the potential of the site archive for further analysis including assessments of environmental samples, artefacts and ecofacts.
- A programme and costing for the full analysis of the site archive, publication of the results and deposition of the archive.

4.24. The results will be submitted for publication in an appropriate regional or national journal within 12 months of the completion of site works.

Site archive

4.25. The overall archive should conform to guidelines described in Management of Research Projects in the Historic Environment (MoRPHE), Historic England 2006, the CIfA (2014) St*andard and Guidance for the Creation, Compilation, Transfer and Deposition of Archaeological Archives, The National Standard and Guidance to Best Practice for Collecting and Depositing Archaeological Archives in Wales* (NPAAW, 2017) and *Guidance for the Submission of Data to the Welsh Historic Environment Records (HERs)*.

4.26. The paper and digital archive should be deposited with the National Monuments Record (NMR), RCAHMW, including a copy of the final report. This archive will include all written, drawn, survey and photographic records relating directly to the investigations undertaken. NMR Digital archives will follow the standard required by the RCAHMW (RCAHMW 2015). A copy of the digital archive only should also be lodged with the Historic Environment Record, Clwyd-Powys Archaeological Trust.

5 Monitoring

5.1. The mitigation works will be monitored by the Clwyd-Powys Archaeological Trust, as appropriate for the duration of the project and depending on the nature of the results. Note that there will be a £150 charge per monitoring visit.

CPAT Report No. 1582

East Rhyl Coastal Defence Scheme

Archaeological Watching Brief

YMDDIRIEDOLAETH ARCHAEOLEGOL CLWYD-POWYS

CLWYD-POWYS ARCHAEOLOGICAL TRUST

Client name:	JBA Consulting
CPAT Project No:	2292
Project Name:	Rhyl Coastal Defence
Grid Reference:	SJ 0219 8242
County/LPA:	Denbighshire
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CPAT Report No:	1582
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Prepared by:	**Checked by:**	**Approved by:**
		
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10 May 2018	16 May 2018	16 May 2018

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Summary

The Clwyd-Powys Archaeological Trust conducted a watching brief, on behalf of JBA Consulting, during the excavation of four test pits in connection with proposals for a new coastal flood defence scheme at Rhyl, Denbighshire.

The results have confirmed evidence provided during previous geotechnical investigations, revealing the presence of tidal flat deposits along the length of the beach at depths of between 1.2m and 1.8m below the current beach level. These deposits increase in thickness from 0.2m in the west to 0.7m in the east. The deposits were seen to contain lenses of peat and other organic remains and have the potential to preserve important evidence relating to coastal change and human activity during the Mesolithic and later prehistoric periods.

1 Introduction

1.1. The Clwyd-Powys Archaeological Trust was invited by JBA Consulting to conduct a watching brief during the excavation of four test pits in connection with proposals for a new coastal flood defence scheme at Rhyl, Denbighshire (Fig. 1; SJ 02265 82483).

1.2. The East Rhyl Coastal Defence Project is a key Denbighshire County Council flood defence scheme to be constructed to protect the Garford Road area of east Rhyl, between an area known as Splash Point and the western boundary of the Rhyl Golf Course. An offshore breakwater with a beach recharge was initially considered to achieve the required form of coastal defence, however the option was rejected following initial coastal hydrodynamic modelling and a scheme to upgrade the existing defences with a new rock revetment and re-curve wall has now been confirmed as the preferred option by the Welsh Government and will be taken forward to design. The intended finish of construction of the project is September 2019 with the preconstruction completed by June 2018 (JBA Consulting 2018, 2).

1.3. A desk-based study (Jones and Watson 2017) was previously undertaken by CPAT to assist in determining between two options to increase the coastal resilience at western Ffrith Beach.

1.4. A programme of ground investigations were undertaken in October 2017 on the upper part of the beach, the promenade and the concrete steps of the existing revetment and recurve wall (JBA Consulting 2018). The ground investigation found that the existing sea defences are built upon an embankment of granular fill typically described as medium dense to dense sandy gravel with a variable cobble and fines content. On the beach, the beach sands typically comprised slightly gravelly to gravelly fine to coarse sands with shell fragments. Beneath the embankment fill of the existing defences or the beach sands on the beach, the ground conditions typically comprised:

- Tidal flat deposits – variously very soft to firm sandy organic silty Clays with subordinate peat and sand layers.
- Fluvio-glacial deposits – variously loose to medium dense gravelly to very gravelly Sands or sandy – very sandy Gravels with a subordinate silt content.
- Glacial Till deposits – typically firm or firm to stiff, locally soft, slightly sandy slightly gravelly Clays, with occasional sand lenses / horizons, locally laminated, becoming stiff to very stiff at depth.
- Weathered Sandstone – bedrock inferred from sand unit, encountered at the base of the glacial till, described as very dense fine to coarse sand with weathered clay and silt laminated beds

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Fig. 1 Location of the East Rhyl Coastal Defence Scheme (in red)

2 Historical Background

2.1. From the end of the last glaciation (c. 10,000 BC) to the early Neolithic (*c.* 4,000 BC) sea-levels rose rapidly (Tooley 1985), followed by a period of lesser oscillatory movements. The local effects were often complicated, not least as a result of isostatic recovery, so that Tooley has identified 12 periods of what he terms 'transgressive overlap tendancies' and a further 12 'regressive overlap tendancies' (Tooley 1982; 1985; 1986). In other words, the sea level rose and fell in broad patterns, but with local variations which sometimes overlapped. Sea level appears to have reached a maximum at about 2,300 BP before falling again (Tooley 1978; 1985). During more stable times, land surfaces would have developed, only to be inundated and subsequently buried beneath marine and estuarine deposits.

2.2. The effect of successive marine transgressions on the area around the mouth of the River Clwyd has been examined by Manley (Manley 1981; 1989), based largely on the results of borehole data. During the Mesolithic period major transgressions may have made Rhuddlan a coastal location, with the low-lying area between Rhyl and Prestatyn transgressed. Areas of elevated boulder clay might have remained above sea level and been occupied as the most seaward habitable land. This may account for the distribution of shell beds and Mesolithic finds reported around Rhyl. The more major transgressions may have covered the elevated boulder clay, although

during periods of regression it is possible that low lying areas may have been settled before being inundated by later transgressions. It is clear that during this period vast tracts of coastal plain were inundated, although the highest absolute sea levels probably occurred during the Roman and early post-Roman period.

2.3. Borehole data from 1984, which was analysed by Manley (1989), revealed peat, suggesting former landsurfaces, at two separate depths, with an upper level at around 2m OD and a lower peat at 1m to 2m below OD. Based on the distribution of cores containing the upper peat deposit Manley postulated the position of a prehistoric coastline in the area of Rhyl town, perhaps dating between *c.* 4000 BC and 3000 BC, between 125m and 600m inland of the present coast.

2.4. Further evidence for coastal change is provided by the remains of a submerged forest on the foreshore, which was noted by Thomas Pennant near Abergele (1784, 349), while a similar phenomenon was revealed at Rhyl in 1893, as detailed in the following account from the North Wales Chronicle (11 February 1893):

> 'The action of the tide at Rhyl within the last few days has disclosed the singular sight of an ancient forest, which, for a period of eighty years has been completely covered by the sea. The scoured portion of the beach where the remarkable sight is presented is situated opposite the Marine Drive, about a mile east of the pier. The town surveyor Mr R. Hughes has made an accurate plan of the place, which shows about thirty trees rooted as they grew, whilst there are a number of horizontal trunks which appear to rest as they fell. Several of the trees have been proved to be of oak and elm, and the remainder appeared to be birch, alder and hazel. The stumps vary in diameter from 12 to 24 inches, and are situated about 100 yards from the edge of the sandhills and are covered during high spring tides by about 10 feet of water. The scoured portion in the sands, which exposes these old roots, extends for about 550 yards in length and varies in width from 7 to 35 yards. Folk lore asserts that this is part of an old forest, the portion in question being known as 'Coed Mawr y Rhyl'.

2.5. The remains on Rhyl beach were recorded again in October 1912 when around 200 tree stumps were recorded between Rhyl pier and about half way from the east end of Rhyl to the centre of Prestatyn, while in august 1918 up to 100 stumps were noted. Birch and scots pine are most commonly found, but also oak, elm and alder (Ashton 1920, 175).

2.6. Archaeological evidence for prehistoric activity along the coastal strip comes entirely from artefactual evidence. Glenn (1935, 207) recorded over 70 prehistoric objects from peat and estuarine or marine clays on Rhyl foreshore, which have also produced an antler mattock, found in 1910, from near Splash Point, which has been dated to 6560±80 BP (Bonsall and Smith 1990). This one of only two such artefacts from Wales and their contexts of discovery suggest that they may have been used for digging, perhaps for shellfish, in soft coastal sediments (Lynch *et al.* 2000, 29). Other artefacts include Neolithic axe heads and a Bronze Age socketed spear head and a bronze chisel.

2.7. Evidence for a continuation of the peat beds, as well as further elements of the submerged forest, has come to light recently in studies associated with the

construction of an on-shore cable connection for the Burbo Bank Offshore Windfarm. Fieldwalking of the intertidal zone identified several areas of exposed peat and one tree stump around 1.25km east of Splash Point (Rutherford 2016).

2.8. The full extent of the peat deposits are currently unknown, although they have considerable potential for artefactual remains and palaeoenironmental data which is considered to be potentially of national importance.

2.9. Remains of possible early sea defences or fish traps (PRN 123322) have been identified within the study area, close to Splash Point, comprising a series of wooden posts set in roughly parallel short trenches filled with stone. These were seen to have been cut through the peat deposits, rather than being associated with the prehistoric finds that have been recovered from the immediate surrounding area (Denbighshire

2.10. It is also evident that the depiction of the sea front on the Tithe map is some 140m further inland than the present front, which has undergone considerable redevelopment, particularly for the leisure and tourism industry.

4 Ground Investigations October 2017

4.1. A programme of ground investigations was conducted in October 2017 by Geotechnics Limited (BH100 to BH104) and Lankelma (WS100CPT to WS104CPT, BH100CPT and CPT100 to CPT111). The ground conditions revealed are summarised below, while the location of the boreholes is shown in Fig. 8.

Strata	**Typical Description**	**Top Level (m AOD) [Thickness (m)]**
Made ground (Concrete)	Concrete - predrilled prior to CPT (Promenade: BH100/100CPT, BH102, BH103, CPT108/8A, CPT109, WS100-WS104B) (Revetment: all HDP / concrete cores)	Promenade: 6.48 - 6.28 [0.16 - 0.34] Revetment steps: 4.61 - 3.18 [>0.67 - 1.51]
Made ground (Embankment Fill)	Sandy Gravel with a variable cobble and fines content. The gravel and cobbles being of mixed lithologies. (BH100, BH102 & BH103, WS100CPT - WS104B, BH100CPT, CPT108 - CPT109 only)	6.28 - 6.02 [2.81 - 4.33]
Marine Beach	Very light brown slightly gravelly to gravelly fine to coarse Sand in places with a high cobble content. (BH101 & BH104, CPT100 - CPT107 & CPT110 - CPT111 only)	2.70 - 1.51 [0.10 - 2.08]
Tidal Flat Deposits	Variously very soft to firm sandy organic silty Clays with subordinate peat and sand layers. (All boreholes and CPT's that penetrated to depth, except CPT100 on the beach at the north-western extremity of the site).	Promenade: 3.21 - 1.94 [1.38 - 4.00] Beach: 1.91 to 0.26 [0.55 - 2.21]
Fluvio-glacial Sands and Gravels	Variously loose to medium dense gravelly to very gravelly Sands or sandy – very sandy Gravels with a subordinate silt content. (All BH's & CPT's except WS104CPT, WS104ACPT & CPT108).	0.89 to -1.08 [1.00 - 4.84]
Glacial Till	Typically firm or firm to stiff, locally soft, slightly sandy slightly gravelly Clays, with occasional sand lenses / horizons, becoming stiff to very stiff at depth. Locally laminated (All CPT's and BH's, except BH104, WS104CPT, WS104ACPT & CPT108).	-2.02 to -4.46 [4.63 - 15.50]
Sand (weathered sandstone)	Bedrock inferred from sand unit, encountered at the base of the glacial till, described as very dense fine to coarse sand with weathered clay and silt laminated beds Encountered in BH100 & BH102 and in all CPT's except CPT102, CPT104, CPT108, CPT108A, CPT109, WS102CPT, WS104CPT & WS104ACPT).	-7.63 to -17.58 [Limited penetration to max 2.15m proven]

5 Watching Brief

5.1. The watching brief was conducted according to the Chartered Institute for Archaeologists' (CIfA) *Standard and Guidance for an Archaeological Watching Brief* (2014), monitoring the mechanical excavation of four trial pits over a three-day period in April 2018. The results are summarised in Fig. 6, while the location of the trial pits is depicted on Fig. 7.

5.2. The ground conditions were such that each of the trial pits proved unstable, owing to the presence of an artesian layer below the beach, and it was only possible to make remote observations as work progressed.

Trial Pit 100 (3m x 5m)

5.3. The overlying beach sand, a deposit of yellowish brown fine to medium sand containing shell fragments and an undiagnostic piece of timber (1.2m in length), was removed to a depth of 0.7m. The underlying deposits were as follows:

- A grey silty sand and coarse gravel (0.2m thick) containing fragments of angular limestone cobbles (assumed to be the eroded remains of the existing rock revetment).
- At a depth of 0.9m-1.9m, a firm bluish-grey sandy silt (Tidal Flat deposit).
- At 1.9m – 2m, a light reddish brown sandy clay containing some organic preservation.
- At 2m- 3m, a firm reddish-grey fine coarse sand and gravel (Glacial Till deposit).
- 3m – 3.1m, as above but firmer. End of excavation owing to rapid water ingress.

Fig. 2 Trial Pit 100, viewed from the south. Photo CPAT 4490-0006

Trial Pit 101 (3m x 5m)

5.4. The overlying beach sand, a deposit of yellowish brown fine to medium sand containing shell fragments, was removed to a depth of 1.0m. The underlying deposits were as follows:

- A grey silty sand (0.4m thick).
- At a depth of 1.0 - 1.2m a firm bluish-grey sandy silt (Tidal Flat deposit).
- At 1.2m – 1.4m, a dark brown peat with organic preservation (Tidal Flat deposit).
- At 1.4m – 1.8m, a silty bluish-grey clay (Tidal Flat deposit)
- At 1.8m – 3.3m, a stiff reddish grey clay, becoming sandier with organic material present at approximately 2m.
- 3.3m – 3.6, as above but sandier. End of excavation due to moderate water inflow.

Fig. 3 Trial Pit 101 viewed from the south, organic peat deposits visible in section. Photo CPAT 4490-0009

Trial Pit 102 (3m x 5m)

5.5. The overlying beach sand, a deposit of yellowish brown fine to medium sand containing shell fragments, was removed to a depth of 1m. The underlying deposits were as follows:

- A dark brown/black silty sand and gravel (5-10cm thick) with cobbles and organic (peat?) material.
- At a depth of 1.5m - 1.8m a firm bluish-grey sandy silt (Tidal Flat deposit). Slow inflow of water between 1m – 1.5m.

- At 1.8m – 2.5m, a firm and fairly dry dark brown peat with organic preservation (Tidal Flat deposit). A 10ltr sample of this material was retained for possible analysis.
- At 2.5m – 2.8m, a bluish-grey silty sand and gravel. End of excavation due to moderate water inflow.

Fig. 4. Trial Pit 102, viewed from the south-east, organic peat deposits visible in section. Photo CPAT 4490-0004

Trial Pit 103 (3m x 5m)

5.6. The overlying beach sand, a deposit of yellowish brown fine to medium sand containing shell fragments, was removed to a depth of 0.4m. The underlying deposits were as follows:

- A greyish-brown silty sand (0.6m thick).
- At 1m – 1.1m, as above but with blackened shell fragments.
- At 1.1m – 1.6m, a grey sandy silty with some plant remains (Tidal Flat deposit).
- At 1.6m – 1.9m, a firm and fairly dry dark brown peat with organic preservation (Tidal Flat deposit).
- At 1.9m – 2.5m, a firm grey sandy silt interbedded with dark brown peat. (Tidal flat deposit). Good wood preservation, some pieces in the round – sample retained.
- At 2.5m – 3m, a brown-grey silty gravel with fine to coarse sand. Some small cobbles present.
- 3m – 3.45m, a reddish brown fine to coarse sand. End of excavation due to moderate water ingress.

Fig. 5. Trial Pit 103, viewed from south. Photo CPAT 4490-0011

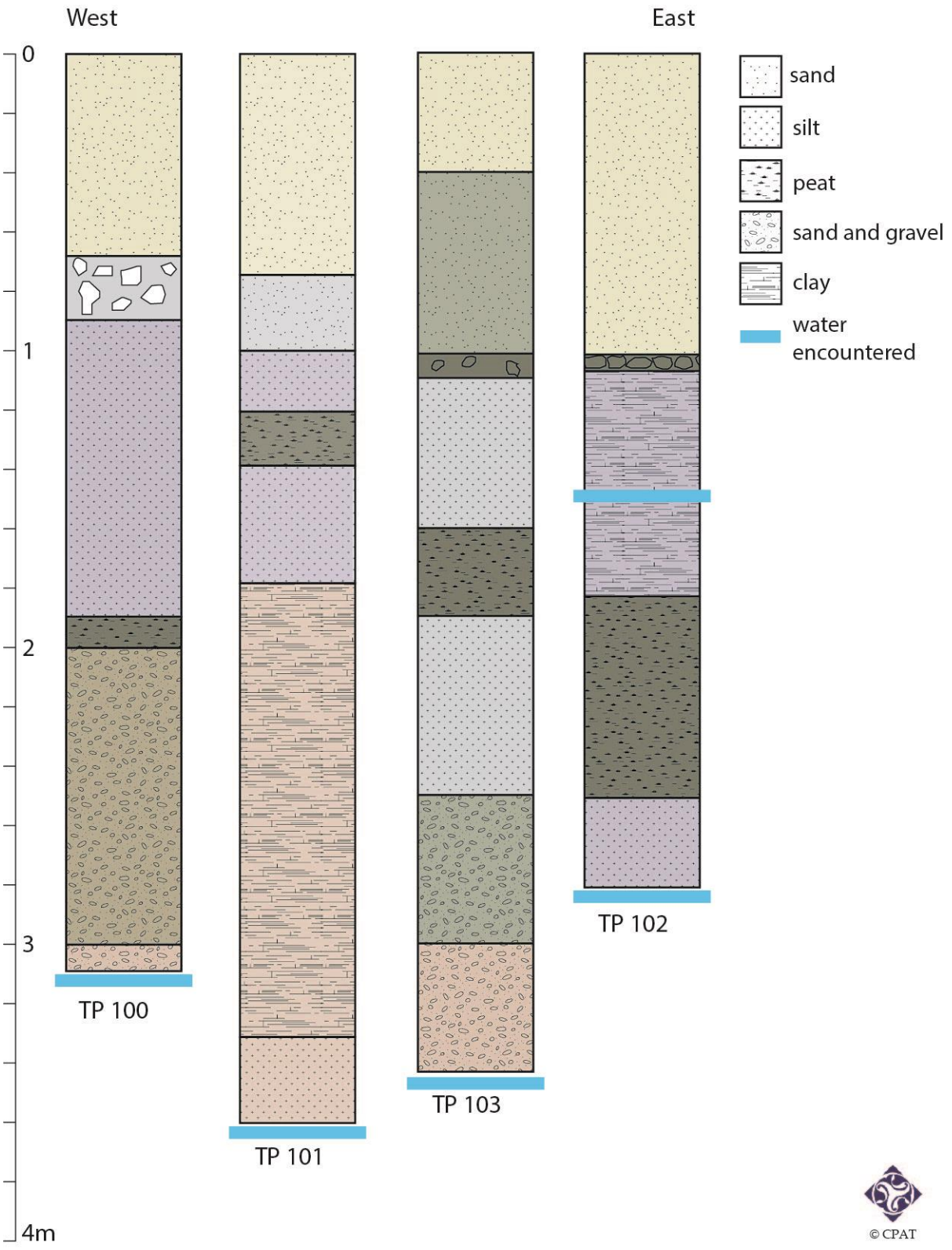

Fig. 6. Stratigraphic record of the test pits

6 Conclusions

6.1. The watching brief was conducted during the excavation of four trial pits on the beach, along the length of the proposed coastal defence scheme. The results have confirmed evidence provided during previous geotechnical investigations, revealing the presence of tidal flat deposits along the length of the beach at depths of between 1.2m and 1.8m below the current beach level. These deposits increase in thickness from 0.2m in the west to 0.7min the east. The deposits were seen to contain lenses of peat and other organic remains and have the potential to preserve important evidence relating to coastal change and human activity during the Mesolithic and later prehistoric periods.

6.2. There is, however, currently insufficient data to assess the likely archaeological potential and significance of the deposits within the study area and further investigations and specialist analysis will be required.

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Cartographic Sources

Map of the Common Marshes and Waste Lowlands in the several parishes of Abergele, St. Asaph,

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1794 Rhuddlan Embankment Act CROH DIDM/275/1(d)

1815 Rhuddlan Enclosure Award CROH QS/ED/14

1819 Ordnance Survey Surveyors' Drawing 319

1839 Rhuddlan Tithe Survey

1839 Meliden Tithe Survey

1842 Enclosure of Rhyl Marsh, 1842 CROH NT/M/10-11

1870 Meliden Enclosure Award 1870 CROH QSIDE/27

1871 Ordnance Survey 1st edition 25" map, Flintshire 1.10

1871 Ordnance Survey 1st edition 25" map, Flintshire 1.11

1889 Ordnance Survey 2nd edition 25" map, Flintshire 1.10

1889 Ordnance Survey 2nd edition 25" map, Flintshire 1.11

8 Archive deposition Statement

8.1. The project archive has been prepared according to the CPAT Archive Policy and in line with the CIfA *Standard and guidance for the creation, compilation, transfer and deposition of archaeological archives guidance* (2014). The digital archive only will be deposited with the Historic Environment Record, Clwyd-Powys Archaeological Trust and the paper/drawn/digital archive with the National Monuments Record (RCAHMW).

CPAT Event PRN: 140238

3 Watching Brief forms

17 digital images, CPAT film no. 4490

4 Sample Record Forms

Samples:

Test Pit 102 – 10lt sample of tidal flat deposit

Test Pit 103 – sample of wood from tidal flat deposit

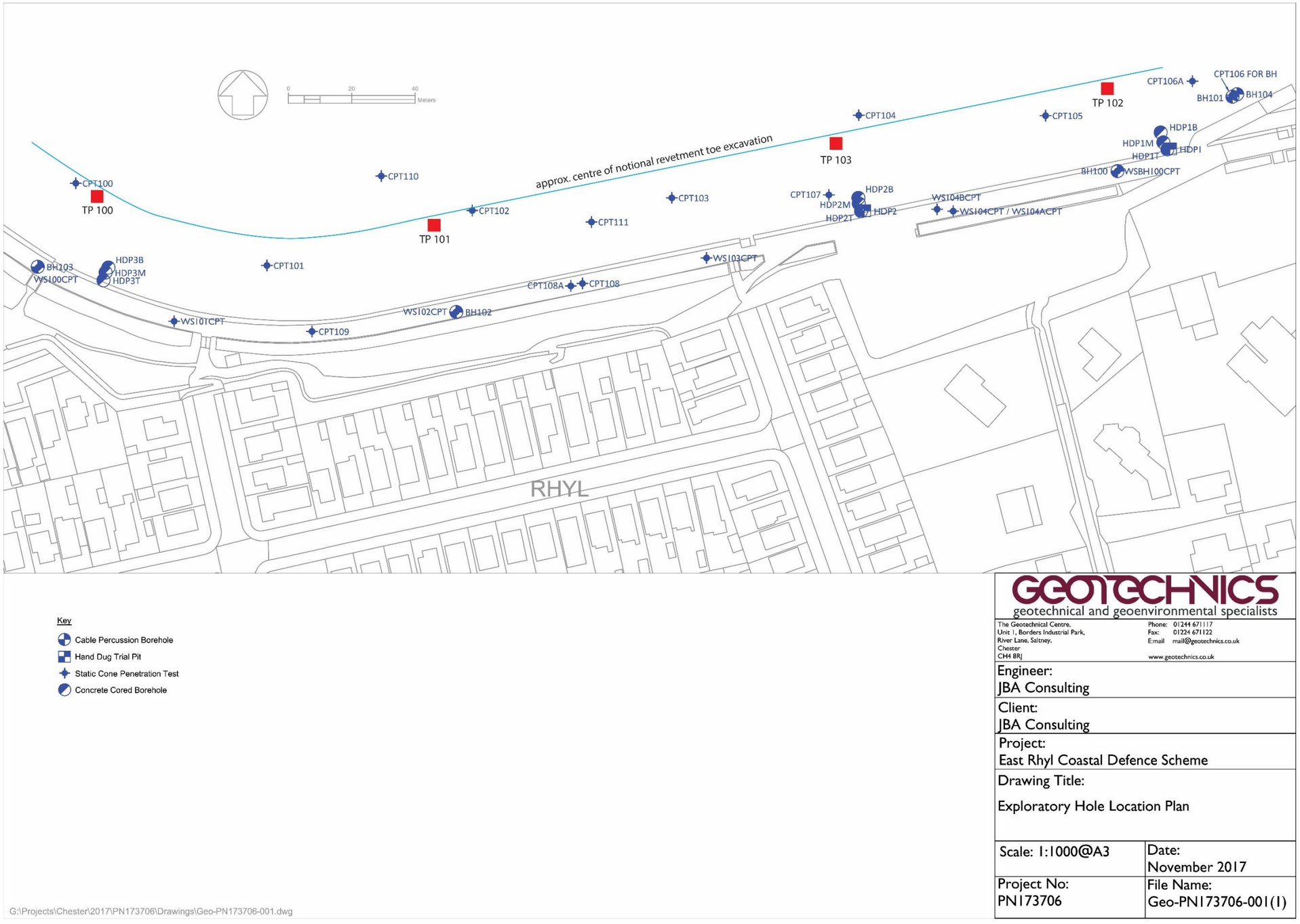

Fig. 7 Ground investigation locations

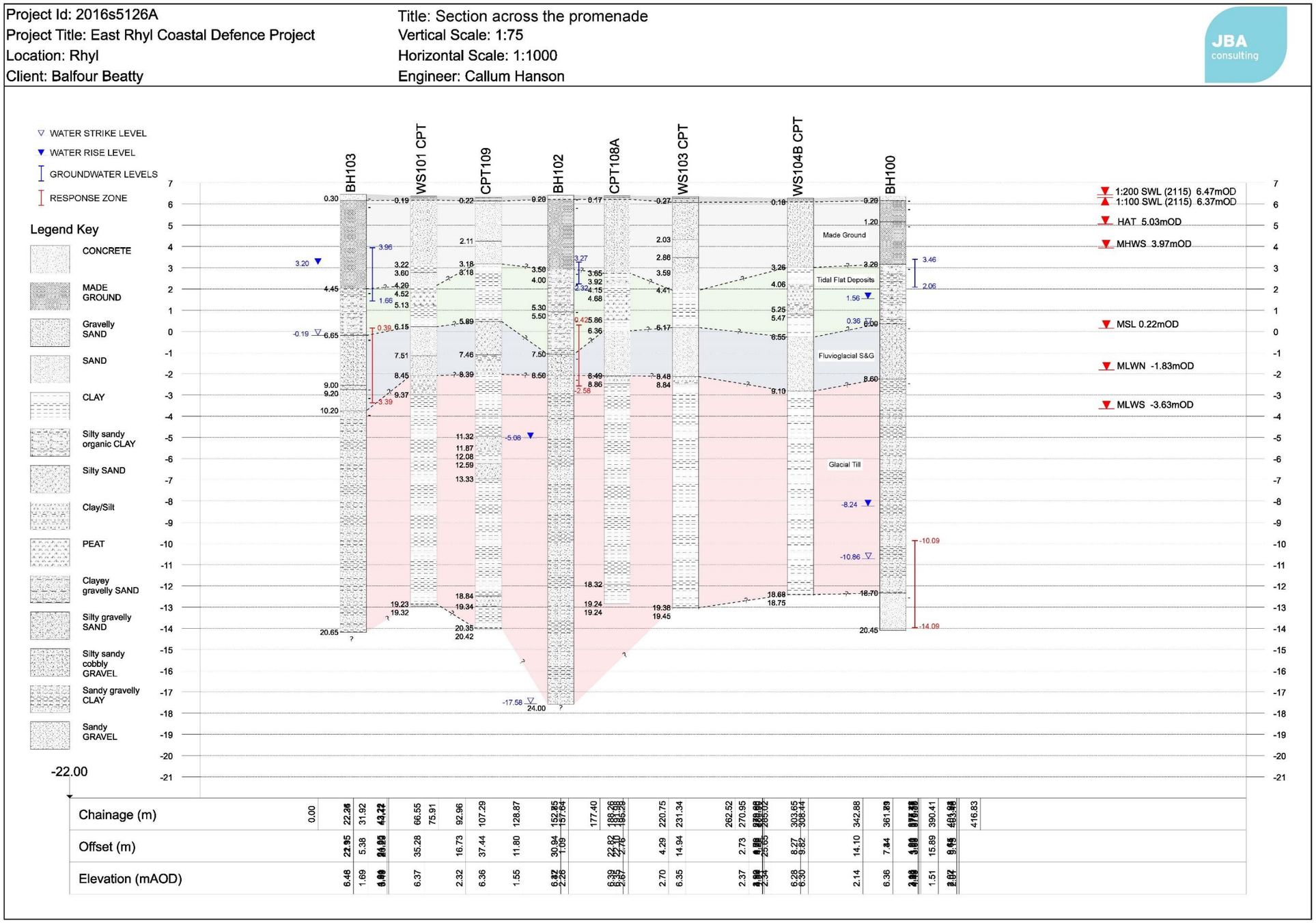

Fig. 8 Stratigraphic section across the promenade (after JBA Consulting 2018)

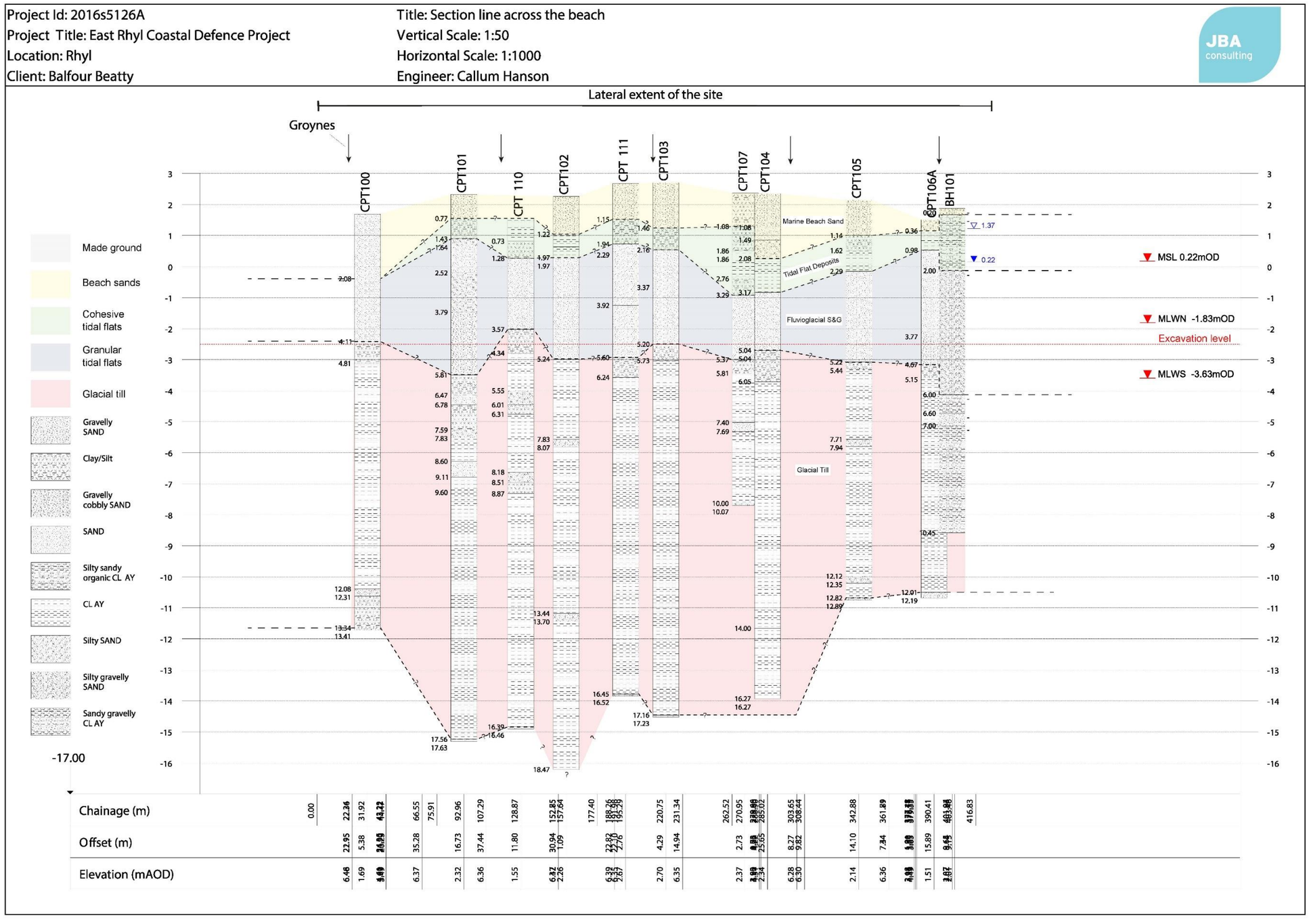

Fig. 9 Stratigraphic section across the beach (after JBA Consulting 2018)