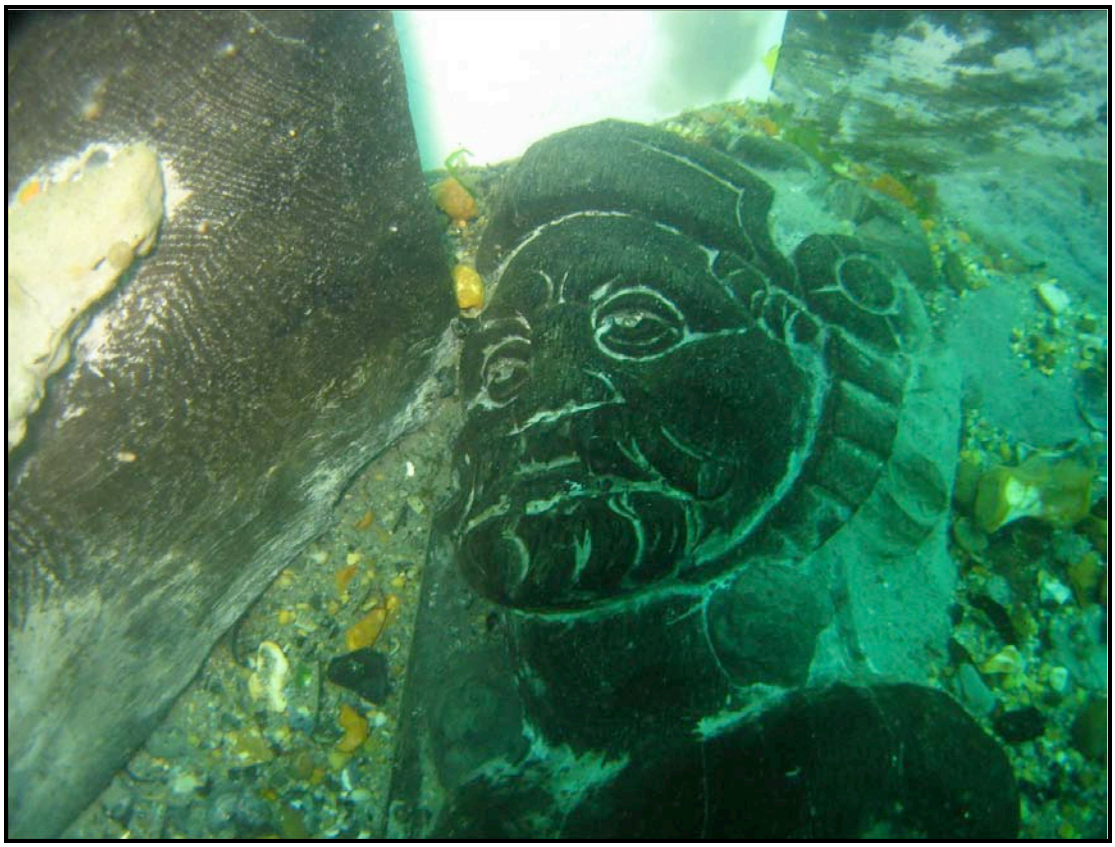
SWASH CHANNEL DESIGNATED WRECK SITE
PROJECT DESIGN
MITIGATION OF A HIGH RISK PROJECTED WRECK
PDSCWE1.5

May 2010



Prepared for English Heritage

Swash Channel Designated Wreck Site

Project Design - Mitigation of a High Risk Protected Wreck

PDSCW (E) 1.5

Contents

Acknowledgements
This document has been written by David Parham with the help of Paola Palma (*in situ* preservation specialist), Nigel Nayling (Consultant), Catherine Gardener and Michael Spender (Poole Museum Services), Ian Panter (Conservation) Mike Allen (Environmental), Andy Ramsbottom (Engineering) and Robert Kranenborg (Lifting Frames). Thanks are due to Alison Hamer and Gareth Watkins of English Heritage for their support and comments on previous drafts

Specialist Terms
Where specialist terms have been used these have been explained using footnotes to provide in depth knowledge.

Executive Summary

The Swash Channel Wreck is the remains of a very large, high status northwest European armed merchant ship wrecked in the approaches to Poole Harbour in the early 17th century, c.1630. The exact character of the originating ship has yet to be established, but evidence collected to date suggest that it was involved in deep sea international trade, almost certainly to the tropics, as part of trading activity organised by a very large mercantile concern. Such activity marks the beginning of north-western European exploitation of connections developed during the voyages of discovery of the 16th century.

To date the evidence collected suggests that the wreck is one of only a handful of shipwreck sites were the physical remains of one the ships involved in this emerging trade survive, with almost 40% of the port side of originating ship being present. Elements of the site are internationally unique and have the potential to provide information for about the conception and construction of the ships engaged in this activity and the nature of this activity itself.

Work conducted since 2006 has shown that the site is currently degrading with significance loss of unique archaeological material. This Project Design proposed how this loss can be mitigated through preservation by record, selective recovery and preservation *in situ* of those parts of the wreck thought to be suitable for such work.

Contents

1 INTRODUCTION

1.1 Summary Description

1.1.1 David Parham at Bournemouth University (BU) has been contracted by English Heritage (EH) to prepare a Project Design for the recording and *in situ* preservation of the Swash Channel Wreck.

1.1.2 The document has been produced with reference to the Institute for Archaeologists *Standards and Guidance for Archaeological Excavation* (IfA, 2008).

1.1.3 The site is that of an early 17th century armed merchant ship. It is located on the edge of Hook Sands (a large sandbank know historically as an area of shipping loss) in the Swash Channel in the approaches to Poole Harbour, Dorset on the south coast of the United Kingdom (see Plan 1).

1.2 Legal Status

1.2.1 The site was designated as an Historic Wreck under the Protection of Wrecks Act 1973 in October 2004 under Order 2004/No.3243. At the time of designation the then Heritage Minster Andrew McIntosh said,

> *This is an important wreck both in historical and archaeological terms. It is likely to be well preserved and rare in terms of its quality and the quantity of the surviving structure and is already yielding invaluable information about ships of this period. This Order is particularly timely as the location of the wreck has been publicised and we need to protect it from potential damage by divers visiting the site.*

1.2.2 Since the site's designation the licence for the site has been held by Poole Harbour Commissioners Harbour Engineer, initially Richard Appleton and currently Andrew Ramsbottom. In 2005 the archaeological advisors for the site were Wessex Archaeology, since 2006 that position has been held by David Parham of Bournemouth University.

1.3 History of Site investigations

1.3.1 The site was first discovered in March 1990 when the Dutch dredger *Scaldis* hit an obstruction whilst undertaking maintenance dredging close to Buoy No 3 in the Swash Channel. The dredge brought substantial timbers and a single iron cannon to the surface. This find was reported and the cannon was acquired by Poole Museum Service. Maritime archaeological activity in Poole at the time was focused on

the Studland Bay wreck and no further action was taken about this discovery.

1.3.2 In order to accommodate modern ferries at all states of the tide Poole Harbour Commissioners (PHC) undertook a capital dredge of Poole Harbour and its approaches to increase the depth in the shipping channel from 6m to 7.5m in the winter of 2005/06. Prior to this work PHC undertook extensive studies of Poole Harbour as part of an Environmental Impact Statement. Part of this work involved geophysical survey of the Swash Channel by Wessex Archaeology, working under contract to PHC, during which an historic shipwreck, the Swash Channel Wreck (the 'Site'), was re–discovered.

1.3.3 During 2004/05 Wessex Archaeology undertook an undesignated wreck assessment (Wessex Archaeology 2005), for EH. The assessment recorded a zone of structure some 20m in length and reported that further remains were known to exist in the area. Importantly the structure showed signs of being recently exposed, and after a short time it was seen to be degrading. Further work undertaken by Wessex Archaeology involved the temporary protection of part of the site by sand bagging in advance of the dredging work, and the recovery of small concretions seen on the surface (Wessex Archaeology 2006a). Wessex Archaeology also undertook mitigation works for PHC in the form of sand bagging, in advance of the capital dredge project (Wessex Archaeology 2006b).

1.3.4 With the site characterised and shielded from dredging, there was an urgent need to establish the character of sediment movement and biological attack. EH and PHC approached BU to monitor the level of physical and biological degradation. This was to be undertaken by a university staff with specialist skills, and benefit from the use of the extensive BU laboratory base and the incorporation of work on site into a taught unit on BU's BSc Marine Archaeology programme to increase capacity within the sector. The combination of funding, staff expertise and student involvement achieved management, research and educational aims exceeding original expectations. Since 2006 the bulk of the work on site has been undertaken by BU students acting under staff supervision.

1.3.5 In May 2006 the site was re-located and it was discovered that the protective hessian sandbags had degraded, and the wreck was once again exposed. In addition, new structure could be seen: the site was considerably more extensive than first thought, covering an area of some 50m × 40m with extensive structural remains over 40m × 20m. It was evident that much more work than was originally anticipated was required. Bournemouth University negotiated sponsorship with a

number of local organisations, notably Dorset Workboats and Jenkins Marine in an attempt to encompass this extra work.

1.3.6 Scientific monitoring has shown extensive evidence of physical, chemical and biological degradation of the archaeological material. As more of the ship's hull is exposed it is subject to severe attack by shipworm (a marine bivalve mollusc notorious for boring into and destroying wooden structures). Also discovered on site was *Lyrodus pedicellatus*, a rapidly destructive, warm water shipworm. Increases in UK sea temperatures due to global warming have allowed this species native of southern waters to thrive here. The species had already been identified on the *Mary Rose* site by Palma: it would appear that this borer is quickly spreading along Britain's southern coasts (Palma et al. 2009).

1.3.7 Because of the clear evidence of rapid degradation in 2007, EH commissioned and part funded a trial using the Swash site as a case study for establishing the most cost effective method of *in situ* stabilisation. Different strategies were deployed over a 12 month period. Rather than just focus on sacrificial samples which could offer limited results, the innovative methodology involved study of the timber decay of the original hull and the efficiency of different protective methods (Palma et al. 2009).

1.3.8 BU had originally agreed to record structure and associated archaeology as it was exposed by erosion, however this proved problematic. The rate of erosion was such that exposure of the ship's structure was proceeding faster than it could be recorded and an unquantifiable amount of material was being lost between site visits. Piecemeal recording of the site in this way also made structured recording impossible and hence interpretation difficult.

1.3.9 Against this background of a partly recorded site and insufficient time in which to record it EH part funded a complete photographic resurvey of the entire site during 2008. This allowed, for the first time, a full understanding of the site's full distribution.

1.4 Finds Recovery

1.4.1 BU's original agreement did not include the recovery of archaeological material but by late 2006 it had become obvious that finds left uncovered on the seabed surface rapidly degraded. An agreement with EH and PHC was produced and BU have, since late 2006 recovered, and are currently storing at their own cost archaeological material that they consider to be at high risk.

1.4.2 BU is now holding over 50 small finds and a number of larger objects in passive wet storage on university premises or at the home of a

member of staff. This work has been undertaken with costs being met by BU and conservation advice provided by Ian Panter at York Archaeological Trust and Angela Karsten at EH. Recording of this material has been undertaken by university student projects and limited specialist analysis has been provided for free by David Gaimster (Society of Antiquarians) and Duncan Brown (Southampton City Heritage). Poole Museum Service have agreed to acquire the archive of the Swash Channel Wreck as a whole as they feel that it is clearly appropriate that all the recovered material and documentation is kept together in one repository (Gardiner & Spender pers. com).

1.4.3 A number of items, notably a carving of a merman and a Dutch Majolica Alborello, are currently being conserved at York with the costs being met by BU.

1.5 Geology, Topography and Marine Life

1.5.1 The site lies in 7-9m of water on Hook Sands, a large sandbank lying adjacent to the approaches to Poole Harbour (See Figure 1).

1.5.2 The substrate around the wreck is mainly sand and shingle, with a few shells and cobbles over laying a sand/gravel matrix that is thought to represent the 'natural' for this site.

1.5.3 This upper layer appears to be fairly mobile, as shown by a lack of attached marine organisms, except on the larger stones or cobbles and the wreck itself. The mobility of the substrate is also suggested by the presence of particular algae that are associated with sand scoured habitats and mobile pebbles and shell (Palma & Parham 2007).

1.5.4 The wreck itself supports a rich community of flora and fauna, many of them are perennial species. Together with the apparent level of development and succession of fouling organisms present, this indicates that the portions of the wreck examined had been exposed for some time. This colonisation is having a detrimental effect on the structure itself (Palma & Parham 2007).

1.5.5 Colonisation of the site by kelp[1], which acts like a sail, transferring forces from the water passing over the wreck to the wreck itself, is aiding the breaking up of the structure.

1.5.6 Scientific monitoring of the site undertaken since 2006 has shown extensive evidence of physical, chemical and biological degradation of the archaeological material. As more of the ship's hull is exposed it is

[1] Kelp are large seaweeds that consist of very large leaf-like blades originating from elongated stem-like structures with a holdfast, a root-like structure that anchors the kelp to the substrate. Gas-filled bladders keep the kelp blades close to the surface, forming relatively low underwater forests.

subject to severe attack by shipworm[2]. Increases in UK sea temperatures due to global warming have lead to the introduction of the much more destructive warm water shipworm *Lyrodus pedicellatus*, to British waters, first identified on the *Mary Rose* site by Palma; it has now been found on the site (Palma 2010).

1.6 Sediment Transport

1.6.1 Unless referenced elsewhere the text below is précised from the SCOPAC (Standing Conference on Problems Associated with the Coastline) Sediment Transport Study. The study relates to the coastline of central-southern England between Lyme Regis (Dorset) and Shoreham-By-Sea (West Sussex) and was conducted by the University of Portsmouth in 1990 and updated in 2004 (Carter, Bray & Hooke 2004).

1.6.2 The ebb-dominant tidal regime in Poole Harbour results in a net southeast (offshore) directed transport of sand delivered to and within the Swash Channel. Conditions in the Swash Channel suggest that sediment transport is strongly dependent upon combined wave and tidal current action and is most intense under the combination of high energy wave action and spring tides. During calm conditions (70% of the time), the mean transport rate is limited with 50-100 times more movement under typical waves (30% of the time) and 500-1000 times more during the operation of storm waves (once per year). Easterly and south-easterly waves can transport sediment westwards from Sandbanks Beach to Hook Sand where it may become entrained by tidal currents operating within the Swash Channel until swept past the 1,500m long Training Bank (see Figure 1 below) where wave modelling suggests that sediment accretes in inner Studland Bay, having been moved from the Swash Channel and Poole Bar.

1.6.3 Part of the crest of Hook Sand lies above -1m OD causing refracted waves to break and sand to be driven onshore from the crest, sand supplied by this pathway may periodically partially infill the Swash Channel (and hence the site) during northerly wind conditions.

[2] A marine bivalve mollusc notorious for boring into and destroying wooden structures.

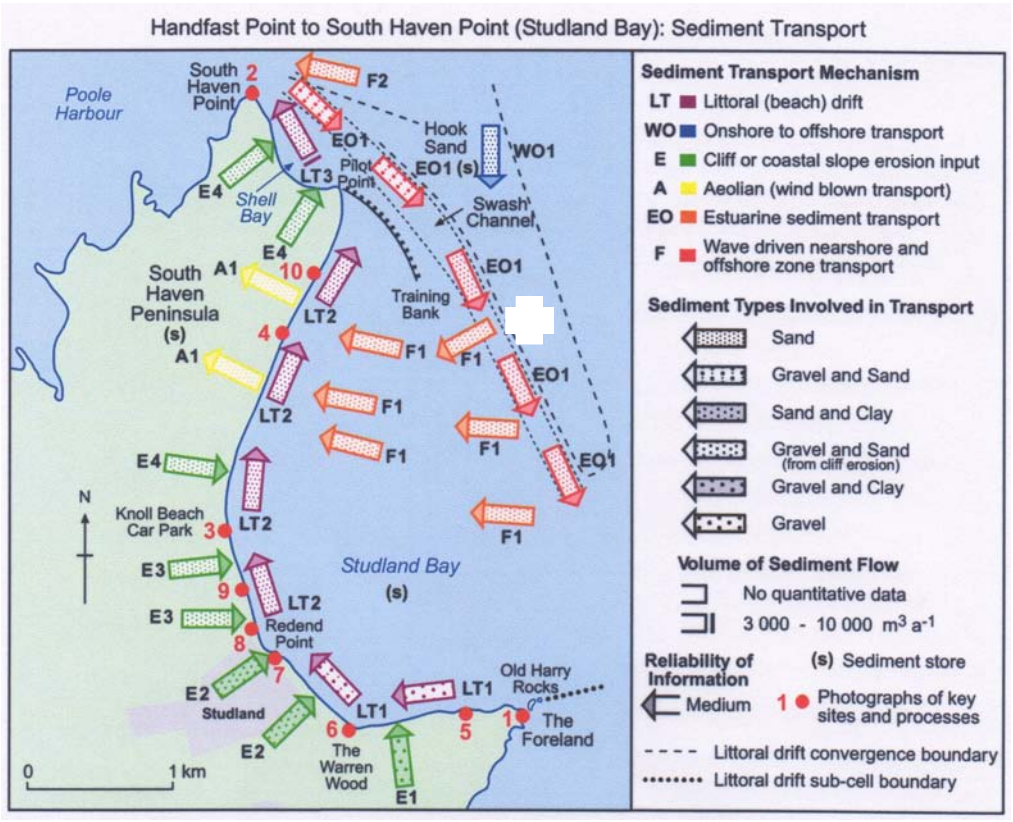


Figure 1. Sediment Transport in the Area of the Swash Channel Poole. The Site is shown as a white cross. (After Carter, Bray & Hooke 2004)

1.6.4 Work on sediment transport within the Swash Channel has results that are limited for a number of conditions. Therefore they can not be extrapolated as long-term trends without more detailed knowledge of the interactions of variables. However, chart comparisons covering the period 1785-1990 revealed that the Swash Channel and Hook Sand were subject to some fluctuation, but were relatively stable in position and platform. This implies a long-term equilibrium between sediment supply and loss.

1.6.5 Studies of the more detailed area around the site were made at the time of its discovery. Comparisons of surveys undertaken between 1910 – 2003 shows a net change in seabed over the Site by c.-1.5m, which are part of larger part of larger changes in Hook Sands (Pearce 2005). Studies by HR Wallingford[3] considered that the process that result in the uncovering of the site are complex, being linked to the detail of localised scouring around any exposed part of the wreck and large scale ongoing morphological change in the area of Hook Sands. Hydrodynamic modelling conducted by them suggested that whilst

[3] HR Wallingford is a consulting company that provides analysis, advice and support in engineering and environmental hydraulics, and the management of water (see www.hrwallingford.co.uk)

sand would erode from the site at periods of significant waves (a once per year event) sand transport patterns showed that changes in the channel caused by its deepening would show a slight increase in the potential for accretion (HR Wallingford 2005).

1.6.6 It is suggested therefore that the general area in which the site lies within is an area of general stability which is fed with sediment predominantly originating from Poole Harbour and occasionally from Hook Sand. Periods of strong tide or wind are known to cause a short term net sediment loss that either moves to the southeast along the channel to the west or southwest into Studland Bay, which has historically been replenished with sediment from Poole Harbour.

1.6.7 The more detailed location of the site, on the edge of the Swash Channel, is one of historic erosion (since 1910) that has resulted in the loss of sediment levels over the site of almost 2m over the last 100 years. The excellent condition of wreck material when originally uncovered indicates that the material was relatively quickly buried when originally lost and has remained buried in the intervening period until an event occurred that began the exposure of the site. This suggests that in the c.300 years between the wreck event and the known erosion that has been ongoing since 1910 the seabed around the site must have been stable.

1.6.8 Since 1910 the detailed area around the site has been subject to erosion that has resulted in the exposure of the wreck site since at least 1990 (the poor condition of some of the timber when the site was located indicates that this event occurred at least several years before 2004). This has been exacerbated by scour caused by the newly exposed wreck structure. HR Wallingford studies suggested that the channel deepening would cause a potential for sediment accretion in the area of the site. This has been supported post dredge by PHC surveys that show no change in the level of sediment in the general area of the site.

1.6.9 The above is at odds with BU sediment monitoring of the actual site which suggests significant sediment loss from the site. It would be reasonable to suggest therefore that the site is itself causing its own demise as a result of localised scouring around any exposed part of the wreck.

1.7 Results of Monitoring Work 2006 - 2009

1.7.1 BU's work has shown that the site was gradually, and is now rapidly being exposed by natural processes that erode its covering of sand exposing archaeological material to rapid mechanical and biological degradation (Palma & Parham 2006, Palma & Parham 2007 & Parham & Palma 2008b).

1.7.2 English Heritage's specification for environmental monitoring on the site (Palma & Parham 2006) required the installation of sediment monitoring rods and since August 2006 sediment levels on the site have been monitored monthly at a series of monitoring stations consisting of two lines of metal stakes, located parallel to and 12m out from the centre line of the visible ship's structure. These are shown as Profiles One & Two in Figure 2.

1.7.3 In agreement with the project specification two rows of sediment monitoring rods were installed on the site in the summer of 2006; Profile One being on the north eastern perimeter of the site and Profile Two on the south western perimeter. Since that date sediment measurements were taken during each site visit. Measurements have shown a continuing reduction in sediment levels across the site.

1.7.4 The data plotted below shows the depth profile, as recorded by the sediment monitoring rods, across the site in August 2006 (the upper line) plotted against the sediment levels record in late August 2009 (the lower line), with the black infill between showing the sediment losses during the monitoring programme.

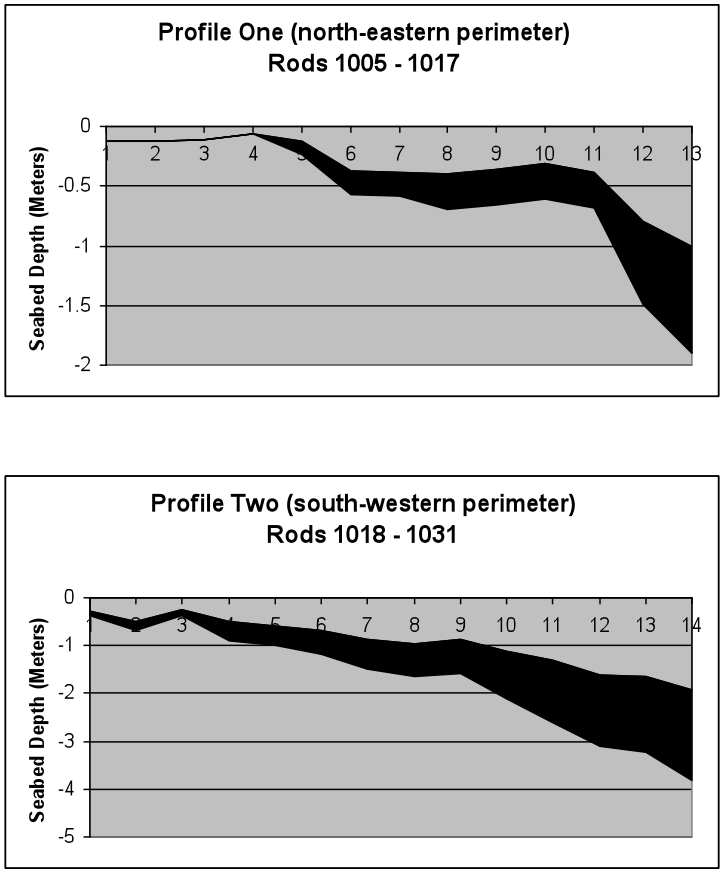


Figure 2. Sediment monitoring profiles.

1.7.5 Since 2006 the average loss of sediment over the site has been in the order of 310mm over an area of 960m². We estimate that sediment loss across the site since 2006 has been in the order of c300m³ or c.500 tons. To put this in perspective it is worth noting that this is approximately the net payload of 527 Ford Transit Vans or 12% of an Olympic swimming pool in volume.

1.8 Site Survey

1.8.1 Since the site was first recorded in 2005 reducing sediment levels across the site have led to an increased area of the site becoming visible.

1.8.2 Figures 3, 4 and 5 below shows the 2008/2009 BU survey and the Wessex Archaeology survey from 2005. It is Bournemouth University's understanding that all visible structure was surveyed at this point, indicating that since the site was first recorded significant

archaeological deposits have become exposed, increasing the area exposed in 2005 by in excess of 500%.

Figure 3. 2008 Photo Mosaic showing visible areas of the site (2009 additions in red)

Figure 4. 2005 Photo Mosaic showing visible areas of the site © WA (same scale as Figure 3

Figure 5. 2005 survey superimposed on the 2008/09, showing the level of recent exposure

1.9 Heritage at Risk

1.9.1 The 2009 English Heritage *Heritage at Risk* Register lists nine shipwreck sites, of which the Swash Channel Wreck is one. The register states:

> *Since the site first came to attention it has proven to be unstable and subject to dramatic shifts in exposure levels. In 2006 sediment monitoring stakes were positioned on site. In 2008 these stakes have revealed up to 300mm loss in sediment across the site, resulting in new exposure. This exposure and the rapid degradation of archaeological material has resulted in the site becoming at risk.*

1.9.2 The register notes that the site's condition is *Extensive Significant Problems* and that the trend is *significant decline*.[4]

[4] See http://risk.english-heritage.org.uk/default.aspx?id=5086&rt=5&pn=1&st=a&ctype=all&crit=

2 ARCHAEOLOGICAL CHARACTERISATION AND SIGNIFICANCE

2.1 Site Description

2.1.1 The site consists of spread of archaeological material covering approx. 40m x 50m. This consists primarily of the remains of a heavily framed carvel constructed wooden ship of c.40m (based on the current understanding of the overall length from the visible remains and the ship's rudder) with associated debris spreading up to 30m to the northwest of the site (see Figure 2). The articulated structure consists of two distinct elements which lie on slightly different orientations, one of these is currently interpreted as being the port[5] bow surviving longitudinally from immediately behind the stem to midships and vertically from a point close to, but probably not adjacent to the keel to the top of the forecastle, including the main deck knees. The other is currently interpreted as being the lower stern surviving longitudinally from the stern post forward to the aft amidships, vertically on the starboard[6] side from the keel to less than 1m above the keel and on the port side from keel to 3m above the keel. Since its discovery in 2006 this element has been interpreted as the ships stern, however some limited evidence collected in the autumn of 2009 may indicate that this may well in fact be the lower bow. Poor weather over the autumn and early winter of 2009 have prevented this being further investigated.

2.1.2 Prior to exposure the preservation of the site was excellent and those elements of the hull that have been exposed are largely well understood. However, this is not yet the case with those elements that are still buried. Rare survivals include:

The Forecastle[7]

2.1.3 This consists of the majority of the port side of the forecastle, up to and including the top rail. This also includes the remains of the ship's galley and circular gunports (see Figure 6). This structure is lying with its outer side facedown on the seabed (and therefore protected) with what was the inside of the structure lying face up on the seabed. This is currently buried under the preservation *in situ* trials, although within the area (Area A- *Section 5.3* below) deemed to be at immediate risk The structure includes at least one carving which is situated at the forward edge of the structure, currently buried face down (see 2.1.5). As part of the ship's superstructure the forecastle is usually swept away during

[5] Left side of a ship
[6] Right side of a ship
[7] The forward part of a ship, medieval ships when equipped for war had a tall, multi-deck castle like structure in the bows of the ship that served as a platform and defensive stronghold. By the 17th century this had become a much lower structure.

the wrecking process and so is an extremely rare survival. No others are known to exist on UK Protected Wreck Sites.

Figure 6. Batavia *Replica, Forecastle highlighted*

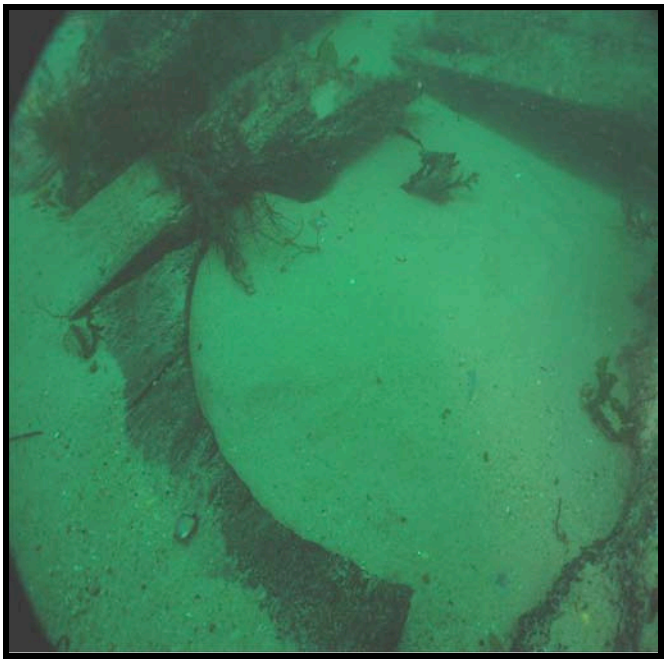


Figure 7. Swash Channel Wreck Gunport

Figure 8. Swash Channel Wreck Forecastle showing the top rail © WA

The Rudder

2.1.4 The ship's rudder survives to its entire length on site and has a carved human face at its head (This is discussed and shown in 2.1.5 below). The rudder is 8.4m long and has 6 pintles[8]. Mainwaring's *Seaman's Dictionary* of 1622 mentions 4, 5 or 6 pintles for a rudder, presumably dependant on the size of the rudder, if this is the case then with six pintles this rudder is from a large ship. Rudders are only in place on a small number of protected wrecks in the United Kingdom. These are;

- the incomplete rudder of the *Mary Rose* (1545) which is missing its upper portion (Marsden 2004)

- the incomplete rudder of the Alderney Elizabethan Wreck Site (c.1590), which is missing its lower portion (McElvogue 1998, Monaghan & Bound 2001)

- the site of the Spanish Armada requisitioned merchantman *La Juliana* at Streedagh Strand in Eire (1588) (Birch & McElvogue & 1999) which has been recorded in sketch plan only and may not have survived *in situ*.

[8] A pintle is a pin or bolt, usually inserted into a gudgeon used as part of a pivot or hinge, it the maritime world it holds the ships rudder onto the sternpost.

The only parallel of a rudder with a carving at its head that has been discovered to date is that of the rudder of the Swedish warship *Vasa* which has a carving attached to the rudderhead (Cederlund & Hocker 2006). At c.10m in length this is somewhat longer than that of the Swash Channel wreck but is superficially similar in form.

Carvings

2.1.5 Two carvings are known to exist on the site, one at the head of the rudder and the other on the outside of the forecastle. One further carving has been raised and is currently in conservation at York Archaeological Trust. All are early Baroque in style, which matches the early 17th century date of the site. The rudderhead carving is that of a male head. The merman carving was found loose within the wreck, but mortises in its back would suggest that it originated from the ship's upperworks and may have been attached to the upper rail. The forecastle carving can only be viewed from the rear but is similar in size and form to the Merman. Carvings are very unusual, on UK Protected Wreck Sites there are only two other examples, the wrecks of HMS *Colossus* (1798) (Camidge 2001) and the Duart Point Protected Wreck Site (1653) (Martin 1995). All of these are later than the date of the Swash Channel Wreck Site. The carvings present on the site are the earliest known in the UK and amongst the earliest known in the world.

Figure 9. Swash Channel Wreck Rudder Head Carving

Figure 10. Swash Channel Wreck Merman Carving

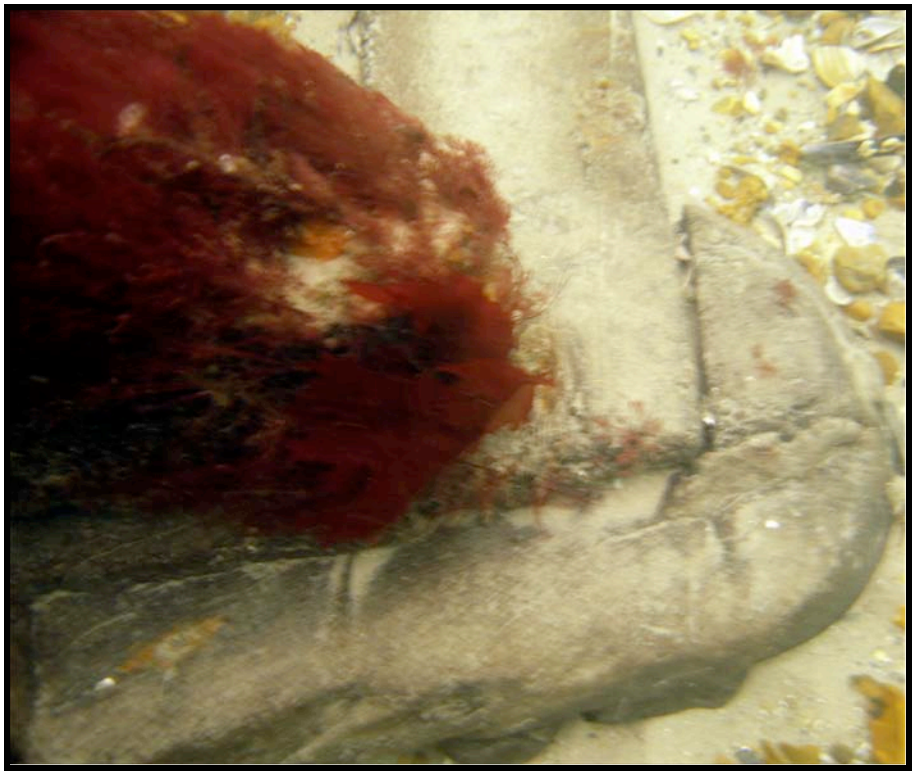


Figure 11. Swash Channel Wreck Forecastle Carving (viewed from back

Other Material

2.1.6 Other Items raised to date include a metal spoon, pottery, butchered cattle bone, a copper alloy hand bell, a copper alloy skillet, leather shoes, lead shot, rigging elements and a wooden tool handle and a gun carriage. Material known to exist on site (in addition to ship's structure) includes seven iron guns, damaged and complete barrels, cannon balls, ballast and possible pump elements. Of particular note are the numerous elements of rigging including the main block for the foremast, large blocks (with running rigging still run through them) and standing rigging. Rigging material is often swept away during the wrecking process or due to its position at the highest part of the ship is

often left projecting above sea level and relatively easily salvaged, so this again is a rare survival. The material currently left *in situ* is temporarily protected to one degree or another but work since 2006 has demonstrated that the site lies within an eroding seabed, and each year more of the wreck is exposed and rapidly decays

2.2 Dating

2.2.1 Dendrochronological samples recovered from the site match the German/Dutch Chronology and suggest an early 17th century date (Nayling, 2006).

2.2.2 To date only a relatively small amount of archaeological material has been recovered from the site. However, all of the datable material suggests an early to mid 17th century date, c.1630. The best parallels for the material culture exist from the site of the *Batavia*, a Dutch East Indiaman built in Amsterdam in 1628 and lost 4th June 1629 on Beacon Island, Western Australia. The best parallels for the carvings, rudder and gun carriage come from the *Vasa*, a major Swedish warship built from 1626 to 1628 in Stockholm and lost on its maiden voyage on 10th August 1628 just outside Stockholm harbour.

2.3 Characterisation

2.3.1 The rudder has been observed to have been clad below the waterline in a light timber sheathing and recent erosion around the hull has revealed areas of the outer hull are clad in a similar way. A sample taken from the outer hull indicates that the hull is clad with an outer sheathing of relatively thin timber (the degraded state of the timber does not allow its original dimensions to be established) with a mat of tarred hair between the sheathing and the outer hull. The timber sheathing is secured by iron nails.

2.3.2 A rapid survey of available relevant literature suggests that there are only three other early 17th century sites where this phenomenon is seen. These are:

Batavia
A Dutch East Indiaman built in Amsterdam in 1628 and lost 4th June 1629 on Beacon Island, Western Australia whist outward bound to the Dutch East Indies. This wreck consists of the portside transom and stern quarter of the ship (Van Duivenvoorde 2005). The hull consisted of double planked oak with an outer pine sheathing (Lemée 2006).

Mauritius
A Dutch East Indiaman of 700-720 tons and c.43m length built 1601 – 1602 in Amsterdam. It made its first voyage to the Indies between 1602 and 1604 and began its second voyage in 1605. During 1606 – 1609 it was used as a local warship in the Indies and began its return voyage

in the autumn of 1609. On 19th December 1609 it was wrecked close to Cap Lopez, Gulf of Guinea on the west coast of Africa. The hull remains consisted of a 13-15m long by 4-6m wide section of the lower midships of the hull with neither the bow nor the stern surviving. The hull consisted of double planked oak with an outer pine sheathing separated from the oak planking by a layer of tar mat and lead sheet. The outer pine sheathing was secured by iron nails (L'Hour, Long & Rieth 1990).

B & W 2 (Possible *Elephanten*)
This is the hulk of an early 17th Century ship found during development at Christianshavn in Copenhagen, Denmark. Dendrochronological analysis indicated that the ship had been built around 1606 and refitted 1618-1625. The hull consisted of a 14.5m x 7.5m section from the stern forward to the midships area. The stern was preserved to 2.3m above the keel and the foremost piece of hull preserved to 2.6m above the keel. The bow and forward end of the ship was missing. The ship showed signs of marine borer damage from tropical waters. The hull consisted of doubled planking with an outer pine sheathing separated from the oak planking by a 5mm thick tar mat with red/brown cattle and animal hair and crushed glass. The pine sheathing was secured by iron nails closely spaced at 7.5-8.5cm intervals in regular lines of a diagonal pattern. The locality of the hulk and the construction history shown by dendrochronology suggest that the hulk is that of the Dutch built Danish East Indiaman *Elephanten* which was originally a Dutch ship that made two voyages to the Indies and was hulked at Christianshavn. Historical records show that the Danish 1618 expedition (in which the *Elephanten* was involved) were prepared for their voyage to the Indies by doubling their hulls and sheathing them with pine boards (Lemée 2006).

2.3.3 The archaeological evidence from the site recorded to date would appear to indicate

- The material culture of the site indicates a early to mid 17th century date, c.1630, with possible Dutch connections.
- Dendrochronological analysis suggests a German/Dutch origin for the timbers sampled and an early 17th century date.
- The sheathing observed on the outer hull of the vessel is only seen on a small number of other archaeological sites, all of which are known to be engaged in voyages to the tropics.
- The size of the rudder indicates that the ship would have been a large vessel for its day (Parham & Palma 2008).

- The lack of extensive heavy armament and the presence of the ship's galley in the bow upper works suggest a mercantile rather than warship function.
- Ships' carvings are items of prestige that are an expensive, non-functional addition to a ship that can in some circumstance cause stability problems and endanger the ship itself. The presence of carvings on a site are usually an indicator of a state funded vessels such as a warship (Lemée 2006), to find such material on a mercantile vessel is very unusual.

2.4 Identification

2.4.1 The above would suggest that the nature of the Swash Channel wreck is that of a large, armed merchant vessel, possibly of Dutch origin adapted for voyages to the tropics. The high status (indicated by the presence of ship's carvings) but mercantile nature of the site suggest that the ship was being operated by a very large mercantile organisation with a need to present itself through its ships as a high status entity.

2.4.2 The most obvious conclusion from this is that the Swash Channel wreck is that of a Dutch East Indiaman. There are however no known such sites listed as being lost off Poole.

2.4.3 The nearest potential candidates are the *Kampen & Vliegende Draeck* lost in 24th October 1627 on the Needles on the western most tip of the Isle of Wight (Larn 1985), which is located almost 15 miles from the site. The loss and subsequent salvage of the two wrecks is a matter of historical fact (Larn 1985) The wreck of the *Kampen* was found in 1979 whilst that of the *Vliegende Draeck* is yet to be located. Historic sources suggest that the *Vliegende Draeck* eventually went aground in a sandy bay on the Isle if Wight (Larn 1985). It is possible, although probably unlikely, that the Swash Channel Wreck is a very large fragment of one of these two wrecks that floated away from the site of these losses as they broke up.

2.4.4 Primary sources dealing with shipwreck material in the area of the site have been consulted as have secondary sources detailing the voyages and losses of both the Dutch and Danish (who are known to have used some Dutch built vessels). None have to date produced an obvious candidate for the origins of the Site.

2.4.5 A Dutch West Africa Company was founded in 1621 which had monopolistic trading privileges in parts of Africa (for the slave trade), the West Indies, Brazil, North America, the Pacific Ocean and parts of New Guinea. The company was organised in a similar way to the Dutch East India Company and was a key component of the Dutch

colonisation of the Americas. Ships of the Dutch West Africa Company under the command of Piet Heyan famously captured the Spanish Silver fleet in 1628. The company was successful during the 1620's and 30's, but then fell into decline in the mid 17th century (Hopkins 2003). Records relating to this company have not yet been consulted.

2.4.6 The late 16th and early 17th centuries saw the beginning of what is known as proto or early modem globalisation. The period is marked by the rise of European maritime empires financed by private enterprise which in turn formed the beginnings of what are know recognised as modern economics. This period saw the exchange of goods, cultures, ideas and peoples between northwest Europe, the Indies and North America, along with less desirable items such as communicable diseases. This rise of European economic empires which in the 18th and 19th centuries became political empires formed the foundation for the integration of economies, societies and cultures which defines the modern world (Hopkins 2003).

2.4.7 This cultural interchange was wholly reliant upon the development of specialist merchant shipping that was capable not only of making successful intercontinental voyages but also capable of carrying sufficient cargo to make the voyage economically viable and sufficient armament to defend itself should the need arise.

2.4.8 As far as can be established only two such vessels from the early 17th century, the *Batavia* and the B & W 2, have been raised and conserved in a way that permits detailed study. This is of great significance as there are no construction plans, lines drawings, or building records for any such vessels of this period (Van Duivenvoorde 2005).

2.4.9 It is argued therefore that from all the evidence discovered to date the Swash Channel Wreck is formed of the substantial remains of a large high status merchant ship engaged in the what can now be seen as the foundation of modern globalisation.

2.4.10 The nature of the activity in which the Swash Channel Wreck was involved was relatively new and what limited evidence we have suggests that the solution to the nature of this work were still experimental. This type of ship is poorly understood, being represented by only a hand full of known shipwreck sites, only three of which have had surviving elements of hull structure and only two of which have been subject to scientific investigation.

2.4.11 The two previous investigations on sites of this nature have understandably been limited by the nature of the remains to the investigation of the lower mid section, lower stern and stern upper works. The Swash Channel Wreck compliments these investigations as it has the remains of the upper bow, rudder, upper midsection, rigging

and possibly the lower bow, none of which are present on the two sites known to have been investigated to date.

2.4.12 In addition to the ship structure described above, the site contains material related to the arming of the ship, its domestic life, provisioning, navigation and possibly cargo which have the potential to provide information about all these aspects of the ship's life and function.

3 PROJECT SCOPE

3.1 Staged Investigation

3.1.1 The project will adopt a staged approach, which is detailed below

Stage 1 Assessment, Monitoring & Characterisation
Stage 2 Rescue Excavation
Stage 3 *In Situ* Protection
Stage 4 Post Excavation Assessment
Stage 5 Conservation
Stage 6 Analysis
Stage 7 Publication
Stage 8 Museum Display

3.1.2 Stage 1 has already occurred.

3.1.3 Stages 2- 4 are the subject of this Project Design.

3.1.4 Stages 6 & 7 are a product (subject to agreement of Stage 4) of this Project Design.

3.1.5 Stages 5 & 8 are not a direct product of this Project Design and are subject to a separate funding route. As detailed in *Interfaces* Poole Museum Service has agreed to acquire and curate conserved material from the site subject to storage limitations. The National Lottery has been approached about funding the conservation of the material from the site and have expressed an interest in doing so.

3.2 Aims of Stages 2 - 4

3.2.1 The international nature, significance and rarity of the site has been discussed in *Nature and Significance* above.

3.2.2 Attempts at piecemeal recording of the site have proved impossible in the past, particularly as the speed of loss of archaeological material outpaces the ability to record it which seriously impedes any attempt of detailed interpretation.

3.2.3 Therefore if the fundamental question of the philosophy behind the conception and construction of the originating ship are to be answered the site must be subject to detailed and structured recording prior to its physical loss through erosion or reburial. The latter will effectively remove its availability for study in the medium to longterm.

3.2.4 The aim of the proposed project is to mitigate the destruction of areas of the Swash Channel Wreck by natural means by controlled excavation, preservation by record (Stage 2) and *in situ* preservation (Stage 3) of those areas of the wreck thought to be suitable for such protection. This will be immediately followed by a Post Excavation Assessment (Stage 4). Work should be aimed at increasing understanding of the Site to allow the follow aspects of the site to be understood;

a) The construction, hull form and building sequence of the site, including theoretical construction of its hull form.

b) The nature of the originating ship's function and use.

c) The nature of domestic life on board.

d) The trading process in which it was engaged when lost.

3.2.5 This will be achieved by meeting the following objectives

a) Recording as much of the hull of the Swash Channel Wreck as resources will allow.

b) Excavating, recording and recovery of the upper bow and rudder for study, conservation and museum display.

c) Excavating, recording and recovery of limited selected areas of the hull that will enable its construction to be better understood

d) Excavating and recording all finds that are considered at risk and/or are uncovered during (a-c) above

e) Covering the structure to prevent contamination of the excavated site from *in situ* preservation works (f) below.

f) Cover the structure with sand to ensure *in situ* protection.

3.2.6 In addition to the primary objectives above the following secondary objectives will be met:

a) Enhancing experience of underwater excavation and the post excavation process amongst the team involved and hence increasing capacity within the maritime archaeological community. Such experience has been hard to gain since the ending of the excavation phase of the *Mary Rose* project in 1982.

b) Via media events connected with the work provide outreach opportunities for the education of the general public about maritime archaeology and raise its profile.

3.3 Business Case

3.3.1 The site has attracted significant public interest. It has appeared repeatedly in the local press, (principally the *Daily Echo*) and on local TV (Meridian TV) and radio (WAVE 105 and BBC Solent) news. In addition it has also appeared in the national press, *The Guardian, Daily Telegraph* and British Satellite News as well more specialist media such as *Diver* Magazine, *Nautical Archaeology* and *British Archaeology*. The site has also received international media in Spiegel Online (Germany) and *Archeologiasubacquea* (Italy) with some coverage in the Indian sub – continent. An open day for the site held at BU on 4th May 2009 (the MAD day) was attended by over 250 people, largely members of the local public but also several prominent archaeologists. The MAD day received more media coverage than any other BU event in the first half of 2009. The *Sunday Times* have indicated that they would be interested in any further events occurring on the site.

3.3.2 The public benefit for this project will be achieved by the preservation by record of those parts of a nationally important archaeological site that are being destroyed by natural processes.

3.3.3 It will meet the following priorities listed in *Taking to the Water* (Roberts & Trow 2002):

a) *Studies designed to improve our understanding of marine site environments and to enhance our ability to assess and predict site stability. An understanding of a site's environment is a fundamental requirement for assessing threats and implementing mitigation strategies; (para 12.5 point 6)* - By enabling us to better understand the natural and archaeological environment that is being destroyed.

b) *Studies designed to develop methodologies that can help seabed developers meet their obligation under Environmental Impact Regulations to identify underwater cultural heritage and mitigate damage incurred in the course of their activities. These could include: desk-based assessment and predictive modelling; archaeological analysis of existing survey data; methods of field evaluation of potential sites and landscapes; protocols for mitigating the impact of operations on archaeological remains; protocols for monitoring sites during and after operations; and dissemination. (para 12.5 point 9)* - By aiding the methodological development of field evaluation of underwater sites

3.3.4 It will meet Research A2 –*Spotting the Gaps: Analysing poorly understood landscapes, areas and monuments* of Theme A

Discovering, Studying And Defining Historic Assets And Their Significance listed in *SHAPE 2008* (English Heritage 2008). English Heritage have stated of maritime archaeological sites that *In particular…….. in general terms they are poorly understood*……(Para 3.3) (Roberts & Trow 2002). The investigations detailed in this document will enable a better understanding of a maritime archaeological sites in general and post-medieval shipwreck sites in particular.

3.3.5 It will meet Research Program D4 *Rescue! Threat-led Last Resort Analysis* listed in *SHAPE 2008* (SHAPE No 32144.110) (English Heritage 2008), Section 3B which matches English Heritage corporate objective 3B to ensure that the most significant parts of the historic environment is recorded and monitored to enable their better protection.

3.3.6 When the site was protected in 2005 the then Heritage Minister Andrew McIntosh said:

This is an important wreck both in historical and archaeological terms. It is likely to be well preserved and rare in terms of its quality and the quantity of the surviving structure and is already yielding invaluable information about ships of this period.

3.3.7 Monitoring of the site since 2006 has demonstrated that the site is being eroded by natural processes and that elements of the site cannot be protected *in situ*, which include those rare elements referred to by Andrew McIntosh above. This project therefore aims to preserve by record those elements of the Swash Channel wreck that cannot be preserved by any other means.

3.3.8 This project is designed to ensure that the most significant parts of the historic environment are recorded. The site is one of the few known internationally that contains the remains of a ship engaged with the beginnings of the formalisation of inter continental trade and the era of proto globalisation. As such the Swash Channel Wreck is one of the most significant parts of the historic environment.

3.3.9 Through the involvement of BU students, and the wider public in the eventual museum exhibition, the proposed project will also meet the objectives of *Empowerment Programme A1 – Training Communities* EMPOWERMENT A1: Training communities by involving students in the project who will take the skills and experience they gain from into their future lives.

3.3.10 This project will meet the following priority listed in *The Historic Environment: A Force for the Future* (DCMS 2001)

…to protect and sustain the historic environment for the benefit of our own and future generations

3.3.11 The project will help protect and sustain this important historic site for future generations through investigation, preservation by record and *in situ* preservation.

3.4 Interfaces

3.4.1 The principal objectives of this work are to recover scientifically, record or protect *in situ* the wreck site.

3.4.2 Poole Museum Service has agreed to acquire and curate conserved material from the site subject to storage limitations (Please see section 3.4 which explains this). In addition they feel that the material from the site could make an excellent display that could be used to enhance the museum's capacity and educate the public about maritime archaeology (Gardiner & Spender pers. com.).

3.4.3 Material from the Swash Channel Wreck will significantly enhance Poole Museum Services maritime archaeology offer, which is already strong. Objects from the Swash Channel Wreck are likely to have a strong visual impact and will enhance visitors' understanding and appreciation for maritime archaeological heritage. Poole Museum Services will investigate whether its Scaplens Court Museum, a building which is largely contemporary with the Swash Channel Wreck, would be a suitable venue for the display of structural elements of the ship, such as the Forecastle and Rudder, along with smaller finds.

3.4.4 Poole Museum already has a rich and varied range of maritime archaeology collections, the most significant being a 10m long Iron Age logboat, and site archives, objects and timbers from a 14th century boatyard and the 16th century Studland Bay Wreck, both of which were originally excavated by Poole Museum Service Archaeological Unit. Poole Museum Service and Bournemouth University have also worked successfully in partnership on the publication of the Studland Bay Wreck excavation for a number of years.

3.4.5 Poole Museum Service staff will be involved fully in the post excavation process.

3.5 Nominated Specialists

3.5.1 Specialists that have been identified to carry out anticipated specialist tasks are listed in the table below

Subject	Nominated Specialist
Ceramics	Duncan Brown, Independent Consultant

Conservation	Ian Panter York Archaeological Trust
Dendro-chronology	Nigel Nayling, Lampeter University
Environmental	Dr Mike Allen, Independent Consultant
Faunal remains	Dr Ellen Hambleton, Bournemouth University
Geology	Chris Wood, Bournemouth University
Glass	Dr Hugh Willmott, University of Sheffield
Hull Remains	David Parham, Bournemouth University
Human Remains	Dr Linda O' Connell, Independent Consultant
Leather	Quita Mold, Independent Consultant
Ordnance	Robert Smith, Independent Consultant
Small finds	Dr David Gaimster, Society of Antiquarians

4 METHOD STATEMENT FOR THE ARCHAEOLOGICAL INVESTIGATIONS

4.1 Licensing and 'Wreck'

4.1.1 The following permission will have to be obtained for the proposed work to take place

a) An Excavation Licence from the Secretary of State (via the Advisory Committee on Historic Wreck Sites); this project design will form the basis of an application for such a licence application.
b) Permission will need to be gained from the owners of the Seabed and the Crown Estates. This has been granted in the past.
c) A licence from the Marine and Fisheries Agency for the preservation *in situ* works, initial discussions about this indicate that this will be possible.

4.1.2 Section 9 of the Merchant Shipping Act 1995 requires that the salvor (defined as the person that salves i.e. recovers material) of shipwreck material has to declare this material to the Receiver of Wreck[9] and may be entitled to a salvage award from the owner of the material or the Crown, if the owner cannot be traced, which often results in the item being granted to the salvor in lieu of a salvage award.

4.1.3 To prevent the dispersal of material from the site from participants claiming salvage for items they have individually recovered any participant of the project will be asked to sign an agreement that relates to this and other matters– *Conditions of Involvement in the Swash Channel Wreck Project* (Appendix 3).

4.1.4 In line with past practice all items recovered from the site will be declared to the Receiver of Wreck by David Parham who will then donate them to Poole Museum upon completion of the project.

4.2 Selection and Justification of Areas to be Excavated

4.2.1 Since BU became involved with the site in 2006 their work has shown that the seabed is naturally reducing and exposing archaeological material. PHC work in surveying the channel has shown that away from the site the seabed is stable (see *Sediment Transport* above). BU has confirmed these findings by swimming transects off the wreck and has found that away from the area of the wreck the seabed would indeed appear to be stable. This work was repeated by Wessex Archaeology during their visit in September 2009 and it is understood by BU that the same conclusion was arrived at.

[9] See http://www.mcga.gov.uk/c4mca/mcga07-home/emergencyresponse/mcga-receiverofwreck.htm

4.2.2 The conclusion drawn from this therefore is that the cause of the seabed reduction in the area of the wreck is the wreck itself. This is caused by water movement increasing in velocity as it passes around the upstanding wreck and scouring away sediment as it does so.

4.2.3 In addition the edge of the channel, on which the forward section of the wreck lies, is collapsing to reach its natural slope of around 1:5. This structure now projects above the surrounding seabed by as much as 1.5m. The area affected by this is shown as Area A on Plan 2.

4.2.4 If the areas of wreck that project above the general depth of the seabed are removed and the scour generated depression in which the remainder of the wreck lies, is refilled by the dumping of maintenance dredging spoil[10] then it is suggested that erosion will cease and the remaining wreck will remain preserved *in situ*, at least in the medium term.

4.2.5 The presence of the site so close to Poole Harbour also means that it is possible that the site could be replenished by further dumping of dredging spoil either annually or as required.

4.2.6 As detailed in *Aims of Stages 2 – 4* sufficient excavation should take place to enable the interpretation of;

a) The construction, hull form and building sequence of the originating ship, including a theoretical reconstruction of its hull form.

b) The nature of the originating ship's function and use.

c) The nature of domestic life on board.

d) The nature of the trading process in which it was engaged when lost.

4.2.7 It is proposed therefore that the following should occur;

a) The surviving hull structure should be cleaned to expose it in its entirety.

b) Any finds located within this structure should be recorded *in situ* and then raised.

c) The structure should be planned in accordance with the IFA *Standard and guidance for nautical archaeological recording and reconstruction* (Institute for Archaeologists 2008)[11].

[10] PHC have confirmed that the Swash Channel is planned to be dredged for maintenance annually and that they would be willing to dump spoil from this onto the wreck site.
[11] See www.archaeologists.net/modules/icontent/inPages/docs/codes/NARR2008.pdf

d) In agreement with English Heritage the following areas of the ship's structure should be recovered.

1. Those areas of the wreck which it is considered cannot be protected *in situ* (Area A on Plan 2)
2. The rudder and upper bow, which are key items for the public interpretation of the site and whose importance is to a great part reliant upon the survival of the surface detail of their timbers.
3. Samples of structure whose further disassembly on the surface it is considered will considerably aid the understanding of the originating vessel's form and construction.

4.2.8 Work will start on the most exposed and damaged areas of the site that adjoins the Swash Channel and proceed inwards towards the less damaged area. This way the team will develop its skills on the already damaged areas of the site and should the project be delayed or forestalled for any reason the most at risk areas of the site will have been excavated and preserved by record.

4.3 Excavation and Recording Protocols

4.3.1 Where relevant all archaeological material will be excavated and recorded following procedures laid down in the Museum of London Archaeological Service Archaeological *Site Manual* (MoLAS 1994).

4.3.2 All recording of ship structure will follow procedures laid down in the Institute for Archaeologists *Standard and Guidance for Nautical Archaeological Recording and Reconstruction* (IFA 2008).

4.3.3 With regard in general to the methodological approach of archaeology underwater all work will follow the procedures laid down in *Underwater Archaeology: The NAS Guide To Principles And Practice* (2nd edition) (Bowens 2008).

4.3.4 The site operates a unique number series with numbers SCW 1-1000 and 1200 – upwards allocated for any archaeological object (i.e. small finds, environmental samples, structural elements etc) and SCW 1001-1999 for survey control points (SCW number). Bulk finds from a single context are allocated a single SCW number.

4.4 Detailed excavation and Recording

4.4.1 Two steel grids will be constructed at one end of the wreck. These will consist of a 12m x 6m Kee Klamp®[12] frame joints and 48mm diameter scaffold tube separated into two 6m x 6m areas which in turn will be separated by two movable 6m cross bars. The frame will be positioned as close to the seabed as is possible and supported by six legs (with a capacity to be extended to 1m) which will be fitted rested on sandbags

[12] See www.keesafety.com

to reduce the pointload generated by each leg to approx to 0.06 kg per cm². Each corner will be fitted with a 4 socket cross[13] fitting which will enable the frame to be extended.

4.4.2 Each frame will be separated into 1m² squares by the cross bars which will also be used to support divers above the area being excavated if required.

4.4.3 Once established the frame will be used to mark an individual excavation area. Excavation will then involve the controlled removal of all sediment and finds within the area down to the level of the hull structure or where no hull structure is present until the 'natural' seabed is reached (see *Geology, Topography and Marine Life*). It is not anticipated that this will involve excavating more than 200mm depth in any place

4.4.4 Normally each find, or group of finds, will be allocated an SCW number and recorded in relation to the 1m² square in which they are found. Where the relationship between groups of finds and/or the ship structure is deemed important by the excavator an annotated measured sketch will be made to record this relationship. Once allocated a SCW number any finds, features and deposits will be placed into a suitable container with its numbered tag. At the end of each 1m² square these will be placed into a storage box which will be secured. This in turn will be placed in a Recovery Basket at a suitable time. The Recovery Basket will be secured on the seabed to be recovered to the surface at suitable intervals.

4.4.5 Where environmental samples are taken the reason for there collection will be noted.

4.4.6 It is anticipated that the bulk of this work will involve the use of hand fanning (for the removal of sediment), brushing (for the removal of marine growth) and the use of trowels or brick hammers for the removal of more robust material.

4.4.7 Spoil will be removed by airlifts, or if the situation requires the horizontal rather than vertical removal of spoil, by water dredge. In areas where the site has been consolidated by the addition of sand spoil removal will achieved with the use of a 200mm diameter airlift, in areas where archaeological deposits are known, or expected, smaller 100mm airlifts or water dredges will be deployed.

4.4.8 Once the area has been cleaned it will be recorded by photomosaic using the basic methodological approach utilized for the 2008 photomosaic survey of the Site (Parham & Palma 2008a). Each

[13] see http://www.chdist.com/warehouse-dock-equipment/pipe-fittings/d-6132-9661-1156

photomosaic will be processed at the surface by Wessex Archaeology and used to form an outline plan of the area excavated. This outline plan will then be printed on to permatrace at a scale of 1:20 and enhanced underwater to provide a more detailed plan of the area excavated.

4.4.9 Sufficient joints and scaffold tubes will be made available so that the second 12m x 6m frame can be built adjacent to and joined to the first. This will allow disassembly of the first frame to occur whilst the second frame it's still in place. The third frame will then be assembled adjacent to and joined to the second. This will allow ease of moving from one frame to the next and ensure that no overlaps occur between excavation areas.

4.4.10 Sufficient joints and scaffold tubes will be made available so that temporary extensions can be made to the frame to cover any outlying areas as and when required.

4.4.11 It is anticipated that seven such moves with see the completion of the work on the main structure of the site.

4.5 Outline Palaeo-Environmental Sampling Strategy

4.5.1 It is not anticipated that the site will produce large volumes of environmental material. However, expected material may include sealed or partially sealed containers, containers with remaining residue, small samples of organic material such as caulking & rope, some organic material trapped within spaces within the ship (although the ship appears to have broken up relatively quickly and will have been subject to scouring action during this period).

4.5.2 A structured programme of sampling will be adopted (see Oxley & Allen 2005), which is material type based.

4.5.3 *Objects, items and containers* - All objects, items, and particularly containers will be lifted intact with the surrounding sediment so that any objects (fine bones, waterlogged remains) can be retained by washover flotation (on to 300μm mesh) and sieving. The full nature of the samples would be evaluated/appraised and subsample as appropriate. Full descriptions may be made before processing by the appropriate methods for recovery of proxy palaeo-environmental indicators/ecofacts/small artefacts/waterlogged fined/ecofacts. In general this would be a form a laboratory bucket washover flotation sieving with mesh sizes to 250μm/300μm but dependent upon appraisal and the material to be recovered. Subsamples could be taken for pollen, or chemical appraisal etc.

4.5.4 The position of all samples will be recorded as will all finds as detailed in the method statement for excavation ie to the nearest sq metre, or if

needed precisely against the primary site datumn. The reason for their recovery will be noted in the finds database at the time of recovery

4.5.5 Samples of sediment for macroscopic waterlogged plant remains and organic remains will be taken in 10 litre tubs and retained sealed and wet for washover flotation. These are samples specifically taken were the waterlogged plant remains in particular are likely to be present. Often assessed for insects and paraffin floated

4.5.6 *Ropes/Sails* - These will be processed as 5.8.2

4.5.7 *Caulking* - These will be processed as 5.8.2

4.5.8 *Organic Sediments* - Areas of clearly organic sediment considered to be the fill of the hull will be sampled. These are organic sediment per se which may essentially be the sediment itself and not just or not even the contained ecofacts/artefacts. Sampling of 10 litres should be adequate, but if deposits are expensive then an array of samples will be taken to assess any spatial distribution of organic macrofossils

4.5.9 The sample size and distribution will be appropriate the deposit. Some deposits may cover several meters but be only 1-2cm thick, others may be less than 1m across but still be considered to be important in spatial variability (i.e. within containers). Hence sample size will be dependant on these parameters and it is probably unhelpful to be so prescriptive at this stage

4.5.10 *Palaeo-environmental and Geo-archaeological Record* – These allow record of the sediments themselves, (nature, description, texture, stoniness, stone component) as well recovery of included benthic environment e.g. molluscs (Oysters, gribble, toledos) etc.

4.5.11 Samples of sediment for macroscopic waterlogged plant remains and organic remains will be taken in 10 litre tubs and retained sealed and wet for washover flotation. These are samples specifically taken were the waterlogged plant remains in particular are likely to be present.

4.5.12 *Marine Sediments* – Some control sampling of deposits within and around the wreck will be necessary in order to separate this background out from the ‘in use’ deposits but that is all. To achieve this bulk samples of typically 10 litres (but up to 30 litres) will be taken from sediments within the vessel that had accumulated soon after sinking. Samples, to a maximum of ten, will be taken to assess the spatial distribution of any organic palaeo-environmental remains.

4.5.13 Processing samples – These will be rapidly evaluated (all will be processed to look for presence/preservation) and then a decision made on which to process on the basis of archaeology, context etc and the supply costs of processing and assessment as we don’t know the range and level of samples recovered at this stage.

4.5.14 Samples will be evaluated /appraised against the material type samples. Subsamples may be taken (e.g. samples for bones to be

sieved through mesh of 2mm and 4mm, but a 1-2 litre subsample may be removed for waterlogged remains. For instance a sample of black gloop may be taken for waterlogged remains but subsample may be taken for consideration for pollen – as was done re-iteratively on the *Mary Rose* see Oxley and Allen contributions to volume 5.lll

4.5.15 A programme of course sieving (larger remains and bones) fine sieving (fish bones), washover flotation and sieving (250/300μm mesh) for waterlogged plant remains and washover flotation/sieving and paraffin flotation 250μm/300μm for insect remains will be defined and costed.

4.5.16 *Fish bones* - Conglomerations of bones found within containers will be examined for the possibility of other finer bones (e.g. fish) and bulk samples taken from these including the sediment to allow representative recover of these remains by sieving)

4.5.17 *Sampling* - Samples of small objects and items will be removed in 10 litre tubs with sediment, and retained sealed and wet for washover flotation.

4.5.18 Samples of sediment for macroscopic waterlogged and organic will be taken in 10 litre tubs and retained sealed and wet for washover flotation.

4.5.19 The location of all samples will be spatially recorded.

4.5.20 On occasion deposits consisting of fragile small finds will be recovered as a sample.

4.5.21 On occasion deposits consisting of material of an indeterminate nature will be recovered as samples in order to save diver time.

4.5.22 *Appraisal and Assessment* - The nature and quantity of sampled material will be listed and appraised to ensure that appropriate processing and assessment is undertaken. Full contextual and vocational details will be cross checked and verified. Decisions will be made of which samples should be assessed, and what for, and what processing methods will be required. Some samples may be put aside or discarded at this stage.

4.6 Disassembling of the Forecastle and Recovery of the Rudder, Disarticulated Ship Structure and Large Objects

The Forecastle

4.6.1 It is anticipated that the forecastle does not have structural integrity to be raised without considerable additional support. The forecastle will therefore be disassembled following the general principals described in *The Disassembly of Hull Structure* (Waddell 2007). This procedure has also been followed for the disassembly of the Newport Ship (Nayling pers. com.).

4.6.2 The forecastle will be excavated as described above and a photomosaic produced using the basic methodological approach utilized for the 2008 photomosaic survey of the Site (Parham & Palma 2008a). The photomosaic will be processed at the surface and used to form an outline plan of the forecastle.

4.6.3 Each individual timber will be allocated an SCW number and have two livestock tags with this number fixed to it by copper nails at two separate and widely spaced points.

4.6.4 Sufficient sandbags will be placed on the structure to prevent elements of it floating away during the disassembly process.

4.6.5 The structure will be separated by removing each framing element from the surrounding structure. This will be achieved by pulling the frame away from its attached structure by the use of plastic wedges[14] hammered between the frames to create sufficient space to insert a saw. If required this may be supplemented with the use of a hydraulic jack.

4.6.6 The treenails and/or iron bolts that join the framing element to the surrounding structure will be cut with a pruning hand saw or similar tool and the framing element removed from the structure.

4.6.7 Once all of the frames have been removed the remainder of the structure will be removed from the seabed. Samples will be taken of any caulking or other environmental material encountered and allocated an SCW number.

4.6.8 Once the forecastle has been removed in its entirety the seabed beneath it will be excavated using the methodological approach described for areas of associated wreckage above.

4.6.9 Disassembled timbers will be moved to the SLF and raised to the deck of the DSV by means of a crane.

The Rudder

4.6.10 The rudder is a relatively long narrow wood and iron composite object, 8.4m long and 1.2m wide at its maximum width that weights approx 2.4 tons.

4.6.11 In water Archimedes' principle will reduce this weight by the buoyancy created by the volume of water that the rudder displaces. The rudder will therefore be self supporting in water but probably not when lifted out of the water.

[14] (see Wedge, 6310 at http://extranet.bahco.com/CONndc.asp?Save_UID=1&wp=&GotoCat=true&cmbLanguage=1)

4.6.12 The rudder will be excavated using the methodological approach described above.

4.6.13 Passages will be excavated under the rudder at approximate gaps of 1 metre, depending upon the conditions on site through which cargo straps[15] with an 8000kg safe working load will be passed.

4.6.14 A suitable 'strongback'[16] will be laid on the rudder and fashioned to it with the cargo straps. Care will be taken to ensure that all corners etc are padded to spread the load borne by each strap over as wider area as is possible.

4.6.15 The RLF will be laid on the seabed as close to the rudder as the archaeology of the site will allow.

4.6.16 The rudder will then be raised approx 1.5 metres by the use of lifting bags[17]connected to the strongback on the rudder by means of a long line that terminates 1.5 metres beneath the surface. When the bags reach the surface the rudder will have been raised by that distance. This is preferable to a lift with a crane as the rudder is surrounded by other structural elements and if a crane was used the rudder will almost certainly be dragged a short distance as slack is taken up between the crane and the object being lifted.

4.6.17 The crane wire will be attached to the strongback prior to the lift taking place and once the lifting bags have reached the surface the crane will take over the lift and following directions from a diver positioned above the strongback will move the rudder to a position above the RLF and guided by control wires will lay the rudder onto the RLF.

4.6.18 Once the rudder is secure on the RLF the strongback will be removed and the rudder lashed to the RLF using the same procedure used to fasten the rudder to its strongback. The lift described above will be repeated and the RLF will be raised to the deck of the DSV by means of a crane.

Disarticulated Structure

4.6.19 Elements of disarticulated structure will be moved to a SLF and raised to the deck of the DSV by means of a crane.

Large Objects

4.6.20 Large objects will be assessed individually for lifting. In most cases it is assumed that they will be raised on the SLF. In some cases, such as

[15] http://www.gtf.co.uk/Ratchet-Straps-50mm.html

[16] A strongback is a beam or girder which acts as a secondary support member to existing structure.

[17] A lifting bag is an item of diving equipment consisting of a robust and air-tight bag with strops, which is used to lift heavy objects underwater by means of the bag's buoyancy.

cannon, this may not be suitable. In these cases the object will be strengthened by means of a 'strongback' and then raised to the deck of the DSV by means of a crane lifting against the strong back.

4.7 Cutting and Recovery of Articulated Ships Structure

4.7.1 Prior to this stage a gap in fieldwork operations will occur during which a rapid period of planning will take place when, in consultation with EH, plans complied during the preceding stage of the work will be used to decide which areas of the articulated hull structure will be recovered.

4.7.2 It is anticipated that the main section of the hull to be excavated will have sufficient structural integrity to be raised either whole or in sections without additional support.

4.7.3 To reduce weight the areas between the ceiling planking and the outer hull planking will be cleaned of all sediment, finds or other material.

4.7.4 Each section will be separated from the remainder of the hull by chainsaw at a point(s) agreed between EH and the project team. If necessary this will be cut again to reduce the weight of the hull section to a size that can be easily managed by the lifting capacity and deck space of the lifting vessel to be deployed. This secondary cut(s) will be agreed with EH and placed with regard to the size to which the hull section is to be reduced, to preserve each section's structural integrity and the cut(s) impact on the archaeological integrity of the object. Each hull section will be allocated an individual SCW number.

4.7.5 Each hull section will be lifted initially by excavating around the outer edges of the section to allow strops to be passed beneath it. The section will then be lifted vertically approx 1.5 metres by the use of lifting bags connected to the strops by means of a long line that terminates 1.5 metres beneath the surface. When the bags reach the surface the rudder will have been raised by that distance. The section will then be moved to the side of the site, placed on the seabed and prepared for lifting by a workboat.

4.8 Single Recovery of Objects

4.8.1 Whilst on site small objects will be recovered in bulk when required in the RB or SLF detailed in *Lifting Assets Available to the Project* above.

4.8.2 Large Objects will be excavated and placed on their relevant lifting frames etc. during the course of the project and them lifted in a single combined lifting event using either PHC or JM work boats.

4.9 Finds Processing

4.9.1 During and immediately after the excavation all finds will be processed as per the procedures laid down in the Museum of London Archaeological Service *Archaeological Site Manual* (MoLAS 1994).

4.9.2 All finds will be drawn at 1:10 (where relevant) and photographed.

5 METHOD STATEMENT FOR *IN SITU* PROTECTION

5.1 Basic Principal

5.1.1 The rapid decay of a ship after sinking is a process that can be ongoing unless anoxic conditions are put in place on the site to impede biological organisms, as well as other physical and chemical processes, from attacking the wood provision available. Monitoring the degradation/preservation of archaeological wood is a fundamental step that allows taking informative decisions on the management of the site. The purpose of this work therefore is to re-establish these conditions after the mitigation work has been completed.

5.1.2 *In situ* preservation trials conducted on the site in 2007 (see Palma et al 2009) demonstrated that the most effective method of re-establishing these conditions was covering of the wreck with a minimum of 500mm of a mixture of coarse and fine sediment which is kept in place by the geotextile[18] grade 4000, whose characteristics to limit wood borers' larvae and sediment movement has been established in the MoSS Project (Palma, 2005). Finally the textile is securely kept in place by a layer of sandbags which prevent its movement, a potential hazard to the navigation in the channel and the stability of the protective structure.

5.1.3 The trials referred to above were limited to a small section of the site; the work proposed below uses techniques taken from civil engineering, archaeological *in situ* preservation work conducted in the Swiss lakes (see Hafner 2006) and work in the UK.

5.2 Method to Deployed

5.2.1 PHC have confirmed that they are willing to deploy sediment collected during maintenance dredging within the Swash Channel.

5.2.2 Sediment transport in the Swash Channel is fed by the same two sediment sinks that feed sediment transport on and around the site (see *Sediment Transport* above). It is sediment originating from these two sediment sinks that will deployed onto the site.

5.2.3 For areas where excavation has taken place the structure will be lined with geotextile, to demarcate a barrier between the archaeology and the subsequent *in situ* works. Where necessary any trenches will be lined with geotextile then refilled with sand so that the surface of the refilled trench is level with the surrounding seabed.

[18] Geotextile are permeable fabrics which, when used in association with sediment, have the ability to separate, filter, reinforce, protect, or drain.

5.2.4 Any particularly vulnerable structure that needs support will be supported by sand bags.

5.2.5 The entire site will be covered with geotextile grade 4000 which will be held by placing a sandbag on every square meter of geotextile, with a line of sandbags around the edge. This spread copies that in use on the Studland Bay Designated wreck site located 500m away from the Site and which has been in place for 18 years (Marky pers. com.). This work was inspected by the project team in May 2009 to check its suitability for deployment on the Site.

5.2.6 At strategic locations around the site a number (min. 10) of ground anchors (see above) will be placed in such locations that will allow the levels of sediment to be measured once the work has been completed and monitored later to ensure that these levels are maintained. These will be of a minimum length of 1000mm and screwed 300mm (to provide stability and minimise damage from fishing etc) into the seabed. These will be deployed in areas known to be free of archaeology.

5.2.7 Sediment replenishment will be achieved by sufficient sand/sediment being placed onto the site by deployment from hopper barges. This work will mimic the procedures used in civil engineering for beach replenishment.

5.2.8 BU will provide the contractor with the required outcome and will not specify how this work is to be conducted. It is however understood that a four point mooring[19] will be laid around the site and the position and orientation of the hopper barge established by GPS so that the sediment can be deployed onto the correct area of the wreck. In between sediment deployments divers will check the level of sediment present on the site.

5.2.9 It is estimated that the size of the scour hole on the site is approx 450m² (Length of Site [40m] x breath of site [24m] x depth of sediment estimated as missing [0.5m] x 20%). With the hopper barges having a length of around 600m³ capacity, and allowing for 20% of the sediment being dissipated into the water column as it falls, sediment replenishment should involve three or four barge deployments.

5.2.10 Upon completion the dumped sediment will be covered in geotextile to hinder its dispersal by waterborne currents. This will be secured by

[19] A typical four-point-mooring consists of an X pattern with four anchors at the outside corners and the vessel at the center. By altering the length of the mooring line for each anchor the vessel can change position within the pattern of anchors.

placing a sandbag every 1m² , following the methodological approach used for the Studland Bay Designated wreck site.

5.2.11 Initial protection works on the site used hessian sandbags, which decayed after a period of approximately 6 months. Since then standard duty (70gsm-grams per square metre-fabric) woven polypropylene sandbags as used on the Studland Bay Designated wreck site and in flood defence and construction etc. These have been in used on the site since 2006 and on the Studland Bay Designated wreck site since 1992 with no problems or obvious decay. For these works medium duty (100gsm fabric) sand bags filled with 20mm gravel will be used. The use of higher quality sandbags should ensure a much longer life expectancy for the bag. The use of gravel should mean that if the bag decays or is damaged the gravel, which is considerably less likely to be moved off the Site by the currents present in the Swash Channel will remain in situ.

5.2.12 Monitoring of sediment levels should be undertaken once a month for 6 months after the sediment replenishment has been completed and annually for a minimum of five years, or more often should the need arise.

5.2.13 Any fall in sediment levels across the site can be countered by further sediment replenishment.

6 METHOD STATEMENT FOR POST EXCAVATION ASSESSMENT

6.1 Introduction

6.1.1 The archaeological potential of the data collected on each subject heading will be evaluated. Those areas to be taken forward for analysis and dissemination will be identified from the results of the assessment based on the soundness of the data collection and the ability of the data to answer the research questions posed. In the event of a decision being made not to take undertake further analysis the preliminary results may be included in the final publication as an Appendix.

6.2 Contents of Each Assessment

6.2.1 Provide a factual statement detailing;

a) The quantity of material, divided by category,
b) The provenance of this material and the potential for contamination
c) Comment on any bias observed due to collection and sampling strategies
d) The condition of material and comment on the extent to which an assemblage is likely to be affected by preservation bias and its potential for long-term storage
e) Provide a method statement detailing how this information is to be collated

6.2.2 Each assessment will provide a considered statement regarding:

a) Questions posed in the project design which the data-collection has the potential to answer
b) New research questions resulting from the data-collection
c) The potential value of the data-collection to local, regional and national research priorities
d) In consultation with Poole Museum Service make recommendation regarding the storage and curation of the material, with particular regard to;
    - The immediate and long-term conservation and storage requirements for the data and material held in the site archive
    - The discard policy, making recommendations for retention where appropriate.
e) Produce a costed schedule of work as to how the analysis of this aspect of the project is to be completed Stages, Products and Tasks

6.2.3 Each specialist has been allocated a three-day period to undertake their assessment. This period is of course dependant upon the volume of material raised. This period may have to alter when the fieldwork stage of the project has been completed and the level of material recovered known. EH will be consulted about this when the volume of material raised can be established.

7 STAGES, PRODUCTS AND TASKS

7.1 Outline Programme

7.1.1 It is anticipated that the archaeological excavation of the site proposed in this document will take a suitably experienced team four weeks in the field with 5-8 days for the reburial, dependant upon the PHC timetable. It is anticipated that should the site generate finds and structure to a level seen on the Studland Bay Designated wreck site that post excavation work would continue at a low-medium level of activity for 2-3 years after the excavation has been completed.

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APPENDIX 1 – RV LOYAL HELPER

Technical Data

Dimensions	Length: 23.49m	**Performance**	Range: 900 miles
	Beam: 6.9m		Cruising: 10.5kts
	Draft: 2.8m		Maximum: 13kts
Displacement:	141 tons	**Accommodation**	12 x berths plus crew
Fuel	5.3 tons	**Fresh Water**	3.5 tons
Deck Crane	1.5ton at 5metres	**Inflatable**	20hp outboard engine
Diver Exit / Entry	Platform / Ladder	**Air Compressor**	Hamworthy 13cfm
MCA Workboat Code of Practice		Category 2 - up to 60 miles from a safe haven	
Master / Owner		Frank Elston - Offshore Yacht Master and HSE Diver with over 30 years worth of experience	

www.dorsetworkboats.com

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