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DAVID S. ROBINSON & ASSOCIATES, INC.

Marine Archaeological Consultants

FINAL REPORT

Marine Archaeological Investigation

Removal and Documentation of the
New Bedford Harbor Superfund Site Unanticipated Discovery Shipwreck #2
from the 2015 Task 2 (Submarine Cable Crossing) Study Area

Acushnet River, New Bedford, Massachusetts

DECEMBER 2018

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1.0 INTRODUCTION

1.1 Project Location and Description

This report presents the results of the marine archaeological investigation conducted by David S. Robinson & Associates, Inc. (DSRA) between July 2017 and September 2018 in the New Bedford Harbor Superfund Site (NBHSS), located in New Bedford (Bristol County), Massachusetts (**Figure 1**). This investigation involved the recovery and documentation of the submerged and buried remains of an historical wooden sailing ship encountered as an "unanticipated discovery" on July 5, 2016 in the Acushnet River within the "Upper Harbor Area" of the NBHSS. The submerged vessel remains, termed here, "NBHSS Unanticipated Discovery Shipwreck #2" (NBHSS UAD SW#2), were found by the Jacobs Engineering Group's (Jacobs) harbor dredging sub-contractor, Sevenson Environmental Services, Inc. (Sevenson) during their Jacobs-supervised pre-dredge debris removal operations within the previously-surveyed and archaeologically-cleared 2015 Task 2 (Submarine Cable Crossing) Study Area of the NBHSS Upper Harbor area (**Figure 2**). Pre-dredge debris removal is part of the ongoing federal program of environmental remediation activities presently underway within the NBHSS by the U.S. Environmental Protection Agency – Region 1 (EPA) and their federal agency partner at the NBHSS, the New England District, U.S. Army Corps of Engineers (USACE-NAE). EPA's engineering consultant, Jacobs, is conducting remediation of contaminated soils and sediments within the marine and terrestrial portions of the NBHSS Upper Harbor area on the behalf of the EPA. CR Environmental, Inc. (CR) is Jacobs's principal marine geophysical survey and mapping consultant for the remediation project and DSRA is CR and Jacobs's principal archaeological consultant for the NBHSS. In order to remediate the contaminated sediments within the area of the unanticipated discovery, removal of the NBHSS UAD SW#2 find was required.

1.2 Project History

To assist the EPA in its compliance with federal and state permitting, John Milner Associates, Inc. (JMA) and its marine archaeological consultant, Dolan Research, Inc. (Dolan), and, subsequently, the Public Archaeology Laboratory, Inc. (PAL), conducted pre-disturbance archaeological sensitivity assessments and Phase I archaeological site identification surveys of the NBHSS's marine, intertidal and upland remediation areas between 1999 and 2006 (Cox, Jr. 2000; Kellogg and Klein 2001a, 2001b; Chadwick and Klein 2003; Waller and Robinson 2004a, 2004b; and Waller 2006). In 2016-2017, PAL completed additional pre-disturbance archaeological sensitivity assessment, Phase I, and Phase II terrestrial archaeological investigations of intertidal and upland areas on the eastern side of the Upper Harbor area where more-recently delineated remediation impacts were anticipated onshore and along the shoreline (Elquist et al. 2017).

Secondary and supplemental marine archaeological site identification resurveys of the marine and intertidal portions of the NBHSS Upper Harbor area that were assessed and surveyed previously by JMA and Dolan have been undertaken periodically by CR and DSRA's Principal and Marine Archaeologist, David Robinson, since 2009 (Robinson et al. 2010; Robinson and Wright 2011, 2013, 2014, 2017; Robinson et al. 2015; Robinson 2016). These supplemental marine archaeological surveys were initiated by the EPA and USACE-NAE following the 2009 unanticipated discovery of the submerged and buried remains of the first (i.e., NBHSS UAD SW#1) of multiple historical wooden

shipwrecks dating from the late-eighteenth- to early-nineteenth-century that have been encountered during pre-dredge debris removal operations within the Acushnet River portion of the NBHSS. Like NBHSS UAD SW#2, the unanticipated discovery of NBHSS UAD SW#1 also occurred in the previously-surveyed and archaeologically-cleared Upper Harbor area of the NBHSS (Robinson and Wright 2011, 2013, 2014, 2017; Robinson et al. 2010). The intended purpose of the supplemental resurveying of the NBHSS Upper Harbor area was to further reduce the chances of similar unanticipated discoveries of additional shipwrecks from occurring. In addition to these resurveys, Robinson has also provided on-call marine archaeological services to CR and Jacobs and responded to multiple other unanticipated marine finds of anchors and other small artifacts that have been made in the NBHSS since 2009.

As noted above, the unanticipated discovery of NBHSS UAD SW#2 occurred in an area of the NBHSS that had been subjected to the pre-disturbance marine archaeological survey by JMA and Dolan, as well as to supplemental high-resolution marine archaeological resurvey by CR and DSRA. Absent from the survey data recorded previously by both the JMA/Dolan and CR/DSRA teams was a detectable diagnostic presence of acoustic contacts or magnetic anomalies typically associated with a shipwreck site, such as an area of the harbor floor with an unusual surface texture or elevation change visible in the sidescan sonar or multibeam bathymetric data sets, or a clustered distribution of magnetic anomalies detectable over multiple adjacent and closely-spaced survey track lines. Unfortunately, the gaseous nature of the harbor floor's sediments prevented acoustic penetration and acquisition of informative sub-bottom profiler data, thus rendering it impossible to see buried hull remains or a ballast pile that may have been otherwise visible in the sub-bottom record. The only remote-sensing feature recorded in the vicinity of NBHSS UAD SW#2, but not clearly associated with anything recovered in its documented hull remains, was a single, isolated, and unremarkable low-amplitude (5 gammas), short-duration (10 feet [ft] [3 meters (m)]), monopolar magnetic anomaly (M111) that was recorded on just one of the closely-spaced (i.e., 12.5 ft [4 m] apart) supplemental secondary resurvey track lines surveyed by the CR/DSRA team (**Figure 3**).

The long post-European contact history of early colonization, more than 200 years of intensive maritime use, and subsequent urbanization and industrialization in the nineteenth century and first half of the twentieth century of the surrounding land and waters of New Bedford Harbor has left significant amounts of accumulated debris and modern trash on the harbor floor. The density of this debris and trash has created a situation wherein literally thousands of isolated, low-amplitude, short-duration magnetic anomalies have been documented in the high-resolution data recorded during CR/DSRA's secondary and supplemental surveys of the Upper Harbor area. Consequently, the occurrence of single, isolated, low-amplitude, short-duration magnetic anomaly, such as that found in the vicinity of NBHSS UAD SW#2 is analogous to a single star in a night-time sky full of stars, nearly all of which, in the case of the NBHSS, are caused by isolated debris or modern trash. If the sub-bottom profiler had been able to penetrate the gaseous sediments of the harbor floor and the sensor had passed over the central concentration of hull remains, it is likely that some detectable aspect of them would have been visible; however, this was not the case. As with NBHSS UAD SW#1, NBHSS UAD SW#2 was essentially invisible in the recorded survey data.

When considered from a broader submerged cultural resource management perspective, as well as from the perspective of the EPA and USACE-NAE as they plan and execute future marine archaeological identification surveys within the NBHSS and elsewhere, the absence of a detectable presence in the survey data of either NBHSS UAD SW#1 or SW#2 is a significant cause for concern.

The likelihood seems high that older, less-well preserved, historically significant wooden shipwrecks, like NBHSS UAD SW#1 and SW#2, deposited into the archaeological record in similar environments (i.e., buried beneath gaseous organic-rich sediments), whose ferrous metal elements are completely corroded, will also go undetected during standard, or even high-resolution, marine archaeological remote sensing identification surveys. The implications of this, and the impact it may have on current and future perceptions of the efficacy of commonly employed marine archaeological identification remote sensing survey methods, warrants further consideration by the archaeological research community, as well as by historic preservation officers of federal, state, and tribal agencies whose management decisions are based on the results from pre-disturbance, marine archaeological identification survey programs.

Discovery of NBHSS UAD SW#2 initiated the implementation of a set of established procedures outlined in Jacobs's 2010 Unanticipated Discoveries Plan (UDP) (Rigassio-Smith 2010) developed specifically for the NBHSS after the unanticipated discovery of NBHSS UAD SW #1. In accordance with the UDP, Jacobs reported the find to the EPA and the USACE-NAE, and to DSRA, on July 6, 2016, within 24-hours of its discovery. The NBHSS UAD SW#2 find was described to DSRA by Jacobs as "a large timber…possibly having [attached to it] ribs…[and] boards with round 'peg-like' holes in them." The unanticipated discovery of NBHSS UAD SW#2 occurred when a portion of the find was brought to the water's surface and Sevenson's on-site staff, who recalled the appearance of the NHBSS UAD SW#1 find, immediately recognized it as potentially being the remains of a wooden ship and reported it to Jacobs. The find was kept immobile at the surface until its GPS position could be recorded and a photograph of it could be taken (**Figure 4**). The find's position was recorded and reported by Jacobs as 815398.47 / 2705752.03 (MA State Plane [ft]), a location centered within the Acushnet River inside the city limits of New Bedford near the northern edge of Jacobs's 2015 Task 2 (Submarine Cable Crossing) Area of the NBHSS's Upper Harbor (Joshua Cummings [Jacobs], email to D. Robinson [DSRA], July 6, 2016). The find was then lowered slowly below the water's surface and back down onto the harbor floor, and a temporary 250-foot- (ft) (76-meter- [m]) radius work-exclusion zone was established around it. Remediation work activities then resumed at a different location within the NBHSS outside of the newly-established exclusion zone (Cummings to Robinson, personal communication, July 6, 2016).

After being notified of the unanticipated discovery of NBHSS UAD SW#2 and examining the photograph of the find, DSRA informed Jacobs that it did appear to be the remains of an historical wooden ship, probably similar in age, size, and vessel type (i.e., a sailing ship rather than a motorized ship) to the vessel remains constituting the NBHSS UAD SW#1 find. DSRA then advised Jacobs to: a) ensure that the Massachusetts Board of Underwater Archaeological Resources (MBUAR) and the Massachusetts Historical Commission (MHC) were notified of the find (as stipulated in the NBHSS UDP); and b) recommended that a science-based management approach be developed for the site that involved the collection of additional baseline engineering survey data to inform and help guide the planning and execution of the eventual archaeological recovery and documentation of the find, following essentially the same research protocol as was applied to the NBHSS UAD SW#1 find. Preservation-in-place was not a management option for NBHSS UAD SW#2, because, as noted above, the removal of contaminated harbor floor sediments at the find site was required for their remediation (Robinson to Cummings, personal communication [email and telecom], July 6, 2016).

To obtain the additional baseline engineering information necessary to develop the marine archaeological management response to the unanticipated discovery of NBHSS UAD SW#2, DSRA

recommended, and CR completed in July 2016, a more-detailed high-resolution sidescan sonar survey of an area, fully encompassing and slightly larger than the 250-ft- (76-m-) radius exclusion zone centered on the reported location of the find. DSRA also recommended that the track lines for this high-resolution survey be run on a grid pattern with additional lines run from different heading angles oriented diagonally across the find site to provide multiple layers of overlapping coverage and detailed sonar images of the now partially-disturbed and newly-exposed ship remains.

The post-discovery/pre-removal engineering survey that was performed served dual purposes. First, it confirmed the adequacy of the size of the temporary exclusion zone and allowed DSRA to recommend to Jacobs its reduction to a 60-ft- (18-m) radius area based on the documented horizontal extent of the NBHSS UAD SW#2 site. Second, it provided additional data necessary to begin developing a work plan for the archaeologically-guided, systematic removal and documentation of NBHSS UAD SW#2's hull remains. On August 1, 2016, DSRA reported in an email to Jacobs its recommendations, and stated that CR's new survey data indicated that NBHSS UAD SW#2's exposed wreckage occupied a relatively small area and might only represent the partially preserved remains of the bottom of a ship's hull (Robinson to Cummings, August 1, 2016).

On August 15, 2016, DSRA communicated to Jacobs again via email with an additional recommendation that a second phase of detailed post-discovery engineering survey be performed, prior to the recovery of the NBHSS UAD SW#2 find, to further assess its horizontal extent and to determine if there were additional elements of the hull remains that buried and, therefore, not visible in the detailed post-discovery sidescan sonar data acquired at the site (Robinson to Cummings, August 15, 2016). DSRA's recommended methodology for this second phase of detailed post-discovery engineering survey consisted of conducting additional remote sensing survey (i.e., sub-bottom profiling [in case the disturbance of sediments at the find site had released gases that had been previously problematic to quality sub-bottom profiler data acquisition] and magnetometry) that would be combined with systematic, differential global positioning system- (DGPS-) guided, sub-surface "tile-probing" survey of the harbor floor, performed on a 3-ft (1-m) grid. Tile-probing involves probing bottom sediments with a long, thin, steel rod fitted with a T-handle at its top, which is deployed and operated from the deck of a small survey vessel. Probing results ("positive" probes, where buried hull remains are encountered, and "negative" probes where no buried hull remains are found) are then mapped with GPS and plotted on a plan that includes correlating remote sensing data. CR commented that the magnetometer survey would likely be redundant and not provide much additional information than was provided by the high-resolution magnetic data acquired during the 2016 resurvey of the 2015 Task 2 (Submarine Cable Crossing) Area. Based on CR's comments, this additional phase of more-detailed baseline engineering survey included just the sub-bottom profiling and the tile-probing elements.

CR's processed data from these more-detailed baseline engineering surveys of the NBHSS UAD SW#2 site was provided to DSRA for review. This review indicated that the find's hull remains included additional portions that were buried, as well as newly exposed timbers that had been disturbed when the ship's remains were first encountered. Together with the exposed portions of the hull, NBHSS UAD SW#2's remains were estimated to extend horizontally along their longitudinal axis a distance of approximately 45-50 ft (14-15 m) (**Figures 5 and 6**), based on the available data. About half of the buried hull remains documented through tile-probing were estimated to be covered by approximately 3 ft (1 m) or less of harbor floor sediments. Based on the observed relatively narrow width of the mapped hull remains, it appeared from these more-detailed baseline engineering

surveys that the NBHSS UAD SW#2 find might constitute only a portion of a vessel's hull, perhaps the bottom and the lower part of one side. This kind of preservation (i.e., when the lowest part of half a hull is preserved) is common among older sunken wooden vessels in marine environments, because of the list to one side they often take after settling on the bottom, and the protection from wood-boring organisms that is afforded the lower, buried portions of the hull.

The data from the more-detailed baseline engineering survey also indicated that the types of materials likely to be preserved at the site, while inclusive of the vessel's wooden hull, were likely to include little else of the ship. Iron fasteners and any other ferrous hull components, hardware, or cargo, did not appear to be present based on the acquired magnetic survey data. Again, this overall result is similar to what was observed in the remote sensing data associated with (and in the recovered materials from) NBHSS UAD SW#1, in which all of the iron fastenings and other iron hull components were corroded to the extent that they no longer possessed any substantial ferrous mass detectable with a magnetometer.

DSRA's review and interpretation of the data from these more detailed baseline engineering surveys, as well as experience gained from working on NBHSS UAD SW#1, resulted in DSRA developing recommendations for recovering and documenting NBHSS UAD SW#2. These recommendations were presented to Jacobs, the EPA, and the USACE-NAE as an internal Draft Memorandum Report that DSRA submitted in February of 2017. DSRA's recommendations were then converted into a work plan/project scope-of-work that was submitted to and approved by the EPA, USACE-NAE, MBUAR, and MHC in July of 2017. Implementation of the marine archaeological recovery of NBHSS UAD SW#2 was completed between July 10-14, 2017. Documentation of recovered materials was completed between October 7, 2017 and February 3, 2018. Analysis and report preparation were completed between February and September 2018.

1.3 Project Scope and Authority

Project tasks performed for the marine archaeological investigation of NBHSS UAD SW#2 included the following:

> Task 1. Coordination/Consultation: coordinate with and provide consultation services to CR, Jacobs, the EPA and the USACE-NAE, as directed by CR and Jacobs, to assist the EPA and the USACE-NAE in their technical communications and consultation with other federal, state, tribal, and local agencies, and interested parties (e.g., New Bedford Historical Commission, the Waterfront Historic Area League in New Bedford, the New Bedford Whaling Museum, and the National Park Service's New Bedford Whaling National Historic Park) related to compliance with the NHPA's Section 106, and other federal and state laws pertaining to project-related cultural resource management issues (**Appendix A**). Attend and participate in a preparatory meeting with CR, Jacobs, the EPA and the USACE-NAE staff, prior to the initiation of field operations, as well as in any other meetings requested to attend and participate in during the course of the project.
>
> Task 2. MBUAR Special Use Permit No. #14-001 Revision and Submittal: coordinate with MBUAR and prepare and submit the necessary documentation to revise existing MBUAR Special Use Permit (No. #14-001), in accordance with 312 Code of Massachusetts Regulations (CMR) 2.06(1)(c) (**Appendix B**).

Task 3. Supplemental Research: perform supplemental research as necessary to identify the vessel type, purpose and identity of NBHSS Shipwreck #2. Review the archival documentation assembled during the investigation of NBHSS Shipwreck #1. This documentation includes relevant cultural resource management reports, site files, and State and National Register files of the MHC and MBUAR, the National Oceanic and Atmospheric Administration's (NOAA's) Automated Wreck and Obstruction Information System (AWOIS), the *Encyclopedia of American Shipwrecks* (Berman 1972), historical charts and maps of the area, published and unpublished primary and secondary sources on the area's history, and a review of notes from informal interviews with local persons knowledgeable about New Bedford's maritime history.

Task 4. Archaeological Monitoring of Removal, Transport & Storage of Ship Timbers: coordinate and monitor in the field the archaeologically-guided removal, transport and temporary storage of NBHSS UAD SW#2's individual hull timbers. Communicate directly with the machine operator to ensure that the removal of NBHSS UAD SW#2's individual hull components is done in as systematic a manner as possible, progressing from one end of the vessel to the other. Maintain a field notebook and photo-document hull remains recovery operations.

Task 5. Archaeological Documentation of NBHSS Shipwreck #2's Hull Remains: document, analyze, and interpret recovered hull remains utilizing the same methods that were employed for NBHSS UAD SW#1. Documentation (i.e., documentation performed in addition to that which was completed during recovery operations) will consist of digital scale photographs and measured scale drawings of the dimensions, shapes and surface details of each individual timber (in plan and profile). Each timber will be analyzed and interpreted (to the extent possible) to determine its function and place within the vessel's hull. Wood species identification (an element of the NBHSS UAD SW#1 documentation effort) is not supported for this documentation effort.

Task 6. Reporting: prepare and submit electronically to CR, Jacobs, EPA and the USACE-NAE for review and comment an internal draft marine archaeological report upon completion of Project Tasks 3, 4 and 5 (i.e., supplemental research and removal and documentation of NBHSS UAD SW#2's hull remains). Upon receipt of internal comments, the electronic version of an external draft report will be prepared and submitted to CR and Jacobs for production and external distribution. Upon receipt of external reviewer comments, an electronic copy of the final report addressing those comments will be prepared and submitted to CR, Jacobs, the EPA and the USACE-NAE for external distribution and archiving. The report is to include the following elements:

- Introduction
- Research Design and Methodology
- Results of the Supplemental Research and Field Documentation
- Summary and Recommendations
- References
- Tables
- Figures
- Appendices.

The report's contents and format are to follow the reporting guidelines established by the National Park Service in the Recovery of Scientific, Prehistoric, Historic, and Archeological Data (36 Code of Federal Regulations [CFR] Part 66 Appendix A), MHC's *Historic Properties Survey Manual: Guidelines for the Identification of Historic and Archaeological Resources in Massachusetts* (1992), and MBUAR Regulations (312 CMR 2).

Health and Safety Protocols: Planned marine archaeological fieldwork involves working onboard either CR's, Jacob's, and/or Sevenson's survey vessels, workboats, and deck-barges. This fieldwork, as well as the onshore shipwreck timbers documentation on-site fieldwork, is conducted in close proximity to and, at times, in direct contact with the contaminated recovered remains of NBHSS UAD SW#2 and their associated contaminated sediments. Adoption and compliance with the Jacobs Project Health and Safety Plan for the NBHSS throughout the duration of its field investigations is required. Fieldwork performed onsite at the NBHSS will be conducted wearing Level D personal protective equipment (PPE). This PPE will include, unless otherwise instructed/allowed, at a minimum, safety vest, hard hat, safety glasses, steel toe boots, shirt with sleeves and long pants. For fieldwork conducted during the shipwreck timbers recovery phase of the project, personnel will wear "modified" Level D PPE consisting of hardhat, safety glasses, disposable Tyvek coveralls, steel-toe boots with disposable protective rubber over-boots, and nitrile gloves (i.e., inner and outer gloves when handling ship timbers). Additionally, the requisite PPE for all work conducted within 5 ft (1.5 m) of the water's edge, or on any floating plant will also include a personal flotation device (PFD). All archaeological field staff working on the project must have undergone 40-hour HAZWOPER training, have previous experience working on HAZMAT sites, have undergone the requisite 8-hour refresher training within the last year, and have physician certification for the ability to work on a hazardous waste site, per OSHA regulation 29 CFR 1910.120. They will also hold current certifications in first aid and CPR. Documentation of this training and the associated certifications will be provided to CR and Jacobs prior to the initiation of active participation in field activities. All on-site field personnel will sign in and out using the Daily Sign-In book located at the reception desk in the Jacobs trailer at the front of the NBHSS. All on-site field personnel will also check in with Jacobs personnel as notification of presence on site and to receive an update to any specific requirements for work to be performed. On-site field personnel will also assist the Jacobs Site Safety and Health Officer in complying with foul weather preparedness procedures, as needed and directed.

Remediation activities at the NBHSS are being conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), which specify meeting substantive requirements for federal and state permitting. DSRA's marine archaeological investigations meet the standards outlined in Section 106 of the National Historic Preservation Act of 1966, as amended (54 USC 306108), and its implementing regulations (36 CFR 800), as well as: Massachusetts General Laws (MGL), Chapter 9, Sections 26–27C, as amended by Chapter 254 of the Acts of 1988 (950 CMR 71); the Department of the Interior's *Standards and Guidelines for Archeology and Historic Preservation*; the provisions of the National Contingency Plan (40 CFR 300); and the Occupational Safety and Health Administration's (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) regulations (29 CFR 1910.120). Tasks conducted by DSRA during the marine archaeological investigation of the NBHSS UAD SW#2 site were completed following the project scope of work and work plan (**Appendix C**), under MBUAR Special Use Permit No. 14-001, issued to DSRA, in

accordance with 312 CMR 2, and the rules and regulations established by the MBUAR, under MGL Chapter 91, s. 63, as amended.

1.4 Project Personnel

Qualified marine archaeologist, David Robinson, M.A., R.P.A., president & CEO of DSRA, served as the marine archaeological project manager/principal investigator for this investigation. Mr. Robinson performed/oversaw all aspects of the study's coordination, fieldwork, data analysis, archival research, and preparation of project deliverables. His professional qualifications meet standards established by the National Park Service (36 CFR Part 66, Appendix C). Mr. Robinson was assisted in the field during the shipwreck remains documentation process by DSRA marine archaeological specialist, Noah Robinson.

The marine archaeological recovery of the NBHSS UAD SW#2 remains was completed under DSRA's direction working with field staff from Jacobs and Sevenson. These personnel included Jacobs's Morgan Biddle (student intern), Joshua Cummings (scientist), and John Oktar (superintendent/site manager); and Sevenson's Russell Lambert and Edward Weygand (machine operators), and Craig Demello, Steven Howard, Antonio Mattos, Jr., and Eric Sorell (laborers). Recovery activities were performed under the supervision of the USACE-NAE's on-site Quality Assurance/Quality Control Specialist, Robert Christie.

Pre-disturbance and post-recovery surveys and associated data processing and plotting of the NBHSS UAD SW#2 site was completed by CR's Christopher Wright (certified hydrographer) and Ben Maher (oceanographic technician). CR's Charlotte Cogswell (president and senior ecologist), and Chip Ryther (manager of Oceanographic Operations) were responsible for the management of CR and DSRA's project activities. Overall direction and management of the investigation was performed: by the EPA's David Lederer and Karen Lumino; and the USACE-NAE's Project Manager, Mary Ellen Iorio and Marie Esten, and Archaeologist/Tribal Coordinator, Marcos Paiva. On-site project direction and supervision was provided by Jacobs's Joshua Cummings, Steven Fox (project manager), Mark Gouveia (site manager), John Oktar, Anita Rigassio-Smith (senior environmental engineer). Jacobs's William Kenyon served as the site health and safety officer and was responsible for ensuring that all on-site field work was performed in conformance with the NBHSS's Site Health and Safety Plan, in accordance with the Occupational Safety and Health Administration (OSHA)'s Hazardous Waste Operations and Emergency Response Standard, 29 CFR Part 1910.120.

1.5 Disposition of Project Materials

All supporting documentation collected during the course of this investigation is on file at David S. Robinson & Associates, Inc., 55 Cole Street, Jamestown, Rhode Island 02835. Raw and processed remote sensing survey data products are on file at CR Environmental, Inc., 639 Boxberry Hill Road, East Falmouth, Massachusetts 02536. DSRA and CR Environmental serve as temporary curation facilities for this information until such time as the EPA, working in consultation with the USACE-NAE, and the Commonwealth of Massachusetts, designates a permanent repository.

2.0 RESEARCH DESIGN AND METHODOLOGY

2.1 Archival Research Methods

The primary goals of the archival research conducted for the investigation of NBHSS UAD SW#2 were the same as those conducted for NBHSS UAD SW#1. These goals were to: identify the wreck; determine its origin and specific age; trace its service history; and assess its historic significance within the historic contextual framework of New Bedford.

To accomplish these goals, DSRA reviewed and synthesized the historic contexts prepared for the NBHSS UAD SW#1 study (Robinson et al. 2010), as well as those prepared for earlier phases of archaeological research conducted at the NBHSS (e.g., Cox, Jr. 2000; Kellogg and Klein 2001a, 2001b; Chadwick and Klein 2003; Waller and Robinson 2004a, 2004b; and Waller 2006), and some of the principal references cited in those documents. The synthesis of these reports and documents provided the general framework for interpreting the NBHSS UAD SW#2 hull remains and conducting more focused research to determine its identity.

As part of the archival research effort, DSRA's David Robinson also met with members of the curatorial/research staff of the New Bedford Whaling Museum on February 22, 2018 to inquire about their collective knowledge about shipwrecks in New Bedford Harbor, and about any archival research materials in their collections that might include information specific to the NBHS Upper Harbor Area and the location of the NBHSS UAD SW#2 find. Additionally, DSRA reviewed notes and materials from the archival research Robinson performed in 2009 and 2010 at the New Bedford Whaling Museum's Research Library, in the New Bedford Public Library's Special Collections, and in Special Collections at the Russell Memorial Library (i.e., the Acushnet Public Library). Specific sources that were re-examined included:

- photography and map archives, Old Dartmouth Historical Sketches, New Bedford Ship Registers, and the Henry B. Worth Papers collection of legal documents, deeds and titles to land holdings in Old Dartmouth (Acushnet) held at the Whaling Museum

- New Bedford Public Library's Special Collections' shelved holdings and on-site searchable "New Bedford Newspaper Digital Database" of news articles published in local newspapers between 1792 and 1870 (i.e., the *Columbian Courier*, the *Daily Mercury*, the *Medley*, the *Mercury*, and the *Republican Standard*)

- Russell Memorial Library's Special Collections' shelved holdings, which included the *Fairhaven, Massachusetts - American Guide Series* (Works Progress Administration [WPA] 1939), Franklyn Howland's *History of the Town of Acushnet* (1907), Zeph. Pease and George Howe's *History of New Bedford* (1889), and Daniel Ricketson's *History of New Bedford* (1858) (particularly the accounts of the 1778 British attack on the harbor)

- NOAA's AWOIS database

- Bruce Berman's *Encyclopedia of American Shipwrecks* (1972)

- John Fish's *Unfinished Voyages: A Chronology of Shipwrecks - Maritime Disasters in the Northeast United States from 1606 to 1956* (1989) and

- MBUAR's Digital Shipwreck Database.

In addition to these archival documents, research notes from conversations with the Chair of the Acushnet Historical Commission, Pauline Tiexiera, and senior Commission members, Joyce Reynolds and Allen Parker, were also re-examined for the information that they had provided on the harbor's history and vessels.

2.2 Archaeological Methods

2.2.1 Archaeological Recovery Methods

The archaeological methodology employed to recover the NBHSS UAD SW#2 hull remains was essentially the same as that employed in the recovery of the NBHSS UAD SW#1 ship timbers (see Robinson et al. 2010). A machine fitted with an extra-long arm and grabber attachment was deployed to the site on a spud-barge (**Figure 7**). The spud-barge was accompanied on-site by two hopper-barges. One of the hopper-barges was kept partially water-filled for the temporary wet storage of recovered ship timbers and artifacts, while the other was left dry and used for storing discarded debris and those ship timbers that were too heavily damaged to be identifiable and documented as anything more than splintered wood. Modified Level D PPE consisting of steel-toed boots with protective rubber outer boots, taped-seam Tyvek coveralls, a personal flotation device, inner and outer rubber gloves, safety glasses, hard hat and ear plugs were worn by all field personnel working within the identified hot-zone area on the spud-barge during the debris removal field activity. Continuous air monitoring for hazardous gases was also conducted throughout the performance of field operations. As noted above, the recovery of the NBHSS UAD SW#2 hull timbers was completed between July 10-14, 2017.

Prior to initiating recovery operations, a meeting was held with the involved on-site personnel to discuss logistics and any questions members of the recovery team had. Plots of the pre-recovery geophysical and tile probing survey data were printed by DSRA and brought out into the field to review and discuss with the machine operator to help further inform and guide the recovery process at the NBHSS UAD SW#2 site. The recovery process involved moving the spud-barge into GPS-guided positions over the site and making a systematic series of sweeps with the arm and grabber. The first position for the spud-barge was situated at the southern end of the ship remains with the longitudinal axis of the spud-barge oriented perpendicular to the longitudinal axis of the hull remains. This configuration meant that the grabber could approach the mostly linear hull timbers from their sides, making it easier to: a) relocate them; and b) secure them in the grabber for recovery. Recovery work progressed systematically along the length of the ship's hull remains with the spud-barge and machine moved towards the hull's opposite end in a series of overlapping passes. An approximately 20-x-50-ft (6-x-15-m) rectangular area, oriented in line with the longitudinal axis of the ship remains, could be covered at a single location before the barge had to be relocated to the next position. Once an area was covered, the spuds were raised, and it was advanced further up the hull. Three barge positions were required to provide the initial overlapping coverage of the NBHSS UAD SW#2 hull remains from bow to stern. Once recovery operations were completed in these three overlapping areas, the spud-barge was turned 90-degrees so that a second series of overlapping 20-x-50-ft (6-x-15-m) areas could be covered. The orientation of these areas was perpendicular to and across the longitudinal axis of the hull remains. Five barge positions were completed in this orientation. This

conservative approach for obtaining comprehensive coverage resulted in multiple, overlapping search and recovery passes over the entire NBHSS UAD SW#2 find site within an approximately 50-x-100-ft (15-x-30-m) overall area centered on it. All operations were directed and monitored continuously by DSRA's marine archaeologist, who remained in direct communication with the Sevenson machine operator throughout the operation.

Upon completion of the recovery operation, the water-filled hopper barge was emptied. Cobbles/small boulders thought to possibly be ballast stones were set aside for documentation. The ship's recovered hull timbers were removed and placed onto the deck of the spud-barge where they were double-wrapped into polyethylene-sheet "timber packets" (**Figure 8**). The stones and timber packets were then transported downriver and transferred onto shore at the NBHSS Sawyer Street facility, where they were then moved onto the site's "pad" for temporary storage and documentation by DSRA (**Figure 9**).

2.2.2 Ship Remains Documentation, 3-D Digital Modeling, and Analysis Methods

Recovered NBHSS UAD SW#2 hull remains were documented by DSRA in scale color digital photographs and/or in scale color digital photographs and measured scale drawings. These photographs and scale drawings are included in **Appendix D** at the end of this report. Because of the suspected contaminated nature of the recovered hull remains, modified Level D PPE (i.e., steel-toed boots, high-visibility safety vest, nitrile inner and rubber outer gloves whenever handling or touching the timbers, safety glasses, and a hard-hat [only when working in the vicinity of heavy-equipment operations]) was worn at all times while working with the timbers.

Due to the relatively large size of many of the recovered ship remains, it was necessary to photograph them in a composite format. This, in turn, necessitated the time-consuming task of assembling photomosaics of each side of every photo-documented timber. Assembly of the photomosaics was facilitated by the use of the "merge" function in Adobe Photoshop's CC 2018 software program.

Scale drawings made of each hull element consisted of standard archaeological plan and profile views and, where appropriate, section and detail views. Annotations and notes were also included on the drawings as needed. Additional notes were recorded digitally in the notepad feature of an iPhone. Daily progress reports describing the work accomplished and any observations of interest were submitted at the end of each field day to project staff at CR and Jacobs, which could then be distributed to other members of the project team. Dimensions of individual timbers and of the overall length of the vessel were measured by the vessel's shipbuilders during its construction using standard English measure (i.e., feet and inches); however, for ease of documentation and drawing to scale, the timbers were all measured and drawn to a metric standard, as is the general practice in archaeology and other sciences. Whenever possible, wood grain, knots, bark, naturally curving surfaces and observations about the naturally grown features of "compass timbers" used to create the different hull components were included and noted in the drawings. Also noted was the evidence of former locations of fasteners (i.e., holes and corrosion stains). Notably, as in the case of NBHSS UAD SW#1, all of the vessel's iron fasteners had corroded completely and were absent. In addition to these characteristics, damages to the wood that resulted from exposure to fire, to wood-boring marine organisms, and from simple wear-and-tear from use were also noted and recorded.

As discovered during the NBHSS UAD SW#1 documentation effort, the ability to analyze, understand, and reconstruct the disarticulated ship remains and return some their elements to their approximate *in situ* pre-disturbance configuration was enhanced significantly by employing computerized three-

dimensional (3-D) modeling techniques to the vessel's principal recovered framing members. These simplified digital 3-D model representations of the ship's recovered framing timbers were created using Solidworks' eDrawings Premium 2015 computer software. Each 3-D timber model was generated from DSRA's two-dimensional (2-D) measured plan and profile scale drawings that were made for each recorded timber during the documentation process. This was accomplished by, first, digitally tracing the profile view from the scanned measured timber drawings. Due to the irregular shapes of the timbers, a combination of lines and spline curves was used to trace the outline of each drawn timber. Once a closed profile was created, it was extruded to create a virtual solid object. The outline of the plan view of the 2-D measured timber drawing was then digitally traced onto an orthogonal plane situated directly below the virtual solid body. A cut-extrude operation was then used to trim off the excess material from the virtual solid model, thereby creating an accurate, yet simplified, 3-D representation of the timber. Once the digital 3-D timber models were created, the next step was to add the principal fastener holes in each timber, as well as surface details, such as simulated wood-grain and charring. Adding the fastener holes was particularly important for the holes that once held the clenched iron bolts that had once been in the center of each floor timber and had secured it to the head of the keel. Lining up these holes made it possible to reconstruct the possible positions of the recovered floors along the keel. These holes were "cut" into the digital timber models, again, using the cut extrude operation. The shape and placement of the holes were obtained from the 2-D plan view measured drawings. The fasteners' paths through the timbers, which were oriented at myriad different angles to each other when the vessel was intact, were also traced directly from the 2-D drawings' profile views.

Once all of the digitally modeled timbers were developed, they were combined into a single overall digital model or "assembly." Within this assembly, each of the individual timbers and the keel sections could be examined and moved about by the project archaeologist in the drawing, like virtual 3-D puzzle pieces, to determine how they fit together and to recreate a visual representation of their approximate original *in situ* configuration in the hull, as originally found on the harbor floor. By measuring the angle of deadrise in each of the recovered floors (i.e., the angle of the floors' arms relative to horizontal), and assuming that the deadrise angle of the floors would decrease as you moved forward from the stern towards the broadest and fullest part of the ship's hull, it was possible to arrange the recovered floors in their estimated original, as-built order or sequence as distributed over the length of the hull. With the virtual 3-D composite model of the principal recovered hull-framing elements reassembled, the model could then be visualized in 3-D from an infinite variety of perspectives (e.g., top, bottom, port side profile, starboard side profile, bow view, stern view, isometric views, etc.) for a more-detailed hull form analysis and output than as 2-D images/projections (**Figure 10**).

3.0 RESULTS

3.1 Archival Research Results

Archival research performed for this archaeological investigation focused on providing information pertaining to three related aspects of NBHSS UAD SW#2:

- the history of the development of the greater New Bedford area/Acushnet River as a port, and NBHSS UAD SW#2's place within the context of that development, including its possible association with the 1778 British attack on New Bedford harbor during the American Revolution

- the name/identity of NBHSS UAD SW#2, and

- its relative age, original size, and hull/rig type.

The first two areas of research were addressed by DSRA's review and synthesis of historic contexts presented in the Robinson et al. (2010), Cox, Jr. (2000) and Fitts et al. (2000) reports prepared for the earlier phases of archaeological investigations conducted in the NBHSS. These reports provided the basic context for the historical development of the greater New Bedford Harbor area spanning the late eighteenth through early nineteenth centuries and corresponding with the estimated age of NBHSS UAD SW#2. This review was supplemented by an examination of the local histories of Bristol County, the city of New Bedford, and the towns of Acushnet and Fairhaven, published in the nineteenth and early twentieth centuries (i.e., Crapo [1840]; Gillingham et al. [1903]; Howland [1907]; Hurd [1883]; Pease and Hough [1889]; Ricketson [1858]; and Weeden [1890]), as well as primary documents obtained from the New Bedford Whaling Museum Research Library (WPA 1940; Worth n/d) and the New Bedford Public Library's Special Collections (Cyr n/d). Analysis of documented shipwrecks in the area included a review of the shipwreck list in Cox, Jr. (2000) compiled from the digital shipwreck database maintained by the MBUAR, and the reported vessel casualties published in Berman's (1972) *Encyclopedia of American Shipwrecks*. DSRA also reviewed the online query of NOAA's AWOIS and the shipwreck list in John Fish's *Unfinished Voyages: A Chronology of Shipwrecks - Maritime Disasters in the Northeast United States from 1606 to 1956* (1989). These lists and databases were supplemented by a discussion with the curatorial/research staff of the New Bedford Whaling Museum, and a review of notes from Robinson's informal interviews with the librarians/curators of the Russell Public Library (Acushnet Public Library) and the New Bedford Public Library, as well as the chair and senior members of the Acushnet Historical Commission. All of these sources were consulted in an effort to determine a potential identity for NBHSS UAD SW#2 and to assess its historic significance. The third area of research was addressed by re-analyzing the comparative data recorded for NBHSS UAD SW#1 and information included in Van Horn's (2004) synthesis of historical and archaeological information generated by previous studies of the wreck sites of British and North American colonial merchant vessels dating from the eighteenth century (**Table 2**), the vessel types registered at New Bedford between 1785 and 1850 (**Table 3**), and in the contemporary plans of vessels included in Frederick Henrik af Chapman's 1768 publication, *Architectura Navalis Mercatoria*. Also consulted were McCarthy's *Ship's Fastenings: From Sewn Boat to Steamship* (2005) and the Woods Hole Oceanographic Institution's (WHOI's) *Marine Fouling and its Prevention* (1952).

3.1.1 Historical Context

The lands bordering the Acushnet River comprising the city of New Bedford and the towns of Acushnet, Fairhaven, Dartmouth, and Westport were purchased from Massasoit, Grand Sachem of the Wampanoag, and his son, Wamsutta, in 1652. The entire tract was originally called "Dartmouth" and was incorporated in 1654.

The first colonial settlement of Dartmouth was established in 1660 on the east side of the Acushnet River in the southern portion of present-day Acushnet. Dartmouth's early colonial settlements were initially spare and consisted of scattered farmsteads and garrisons up until the time of King Philip's War (i.e., 1675-1676). During that War, these settlements were overrun and largely destroyed as a result of hostilities with local Native American populations.

Following the War, settlers returned and rebuilt in the area. The Village of Acushnet was established at the head of the Acushnet River, a short distance north of NBHSS UAD SW#2's find-spot. By 1747, Bennett's sawmill and one of the earliest iron mills in the area had been established along Long Plain Road on the banks of the Acushnet River and Deep (or Morse) Brook.

Throughout the first half of the eighteenth century, Acushnet developed to a greater extent than any other area in Dartmouth or around the harbor and served as the region's center and chief port on the river. The first vessels constructed on the river were built at Stetson's shipyard, located about 500 ft (152 m) south of the village bridge (the present-day Wood Street Bridge), on the west side of the river where it widens. The narrowness of the river at the shipyard site reportedly required shipwrights to take great care during the launching of vessels, so as to not run them aground on the muddy bank on the opposite side of the river (Howland 1907). In the early days of this enterprise only smaller wooden sailing vessels were built there, such as those used in the deep-water fishing and coastal merchant trades. However, during the latter part of the eighteenth century, larger vessels were built at Stetson's Acushnet shipyard that were destined for use primarily by the whaling industry.

The Stetson yard was eventually abandoned, and the center of shipbuilding activity shifted a short distance further south to the "Belleville" section of New Bedford. This area became a busy center of maritime activity with the addition of storehouses, a cooper's shop, and other buildings used for ship construction, as well as for supporting the harbor's whaling and freighting businesses.

In 1787, Fairhaven (which at that time included New Bedford and Acushnet) separated from Dartmouth. The three towns remained one municipality until 1812, when Fairhaven, which still included Acushnet, split off from New Bedford with the Acushnet River forming the natural boundary between the two communities. With the continued growth of New Bedford, Fairhaven and Acushnet, the latter town eventually separated from Fairhaven in 1860 to become its own town.

The spacious and natural harbor formed by the Acushnet River estuary has been used for more than three centuries by commercial, military, and recreational vessels. As is the case today, the fisheries were the principal maritime industry of the greater New Bedford area during the earliest years of the port's development. Initiated in New Bedford in 1690, whaling replaced fishing between 1820 and 1857 as the area's primary maritime industry. Led by the enterprises of the Russell and Rotch families, New Bedford's whaling industry grew to include 50 vessels by 1775 (Morison 1921; Pease and Hough 1889).

New Bedford's harbor was the only port north of the Chesapeake Bay that was not occupied by the British during the early part of the Revolutionary War. Protected by a newly-constructed fort situated at the present-day location of Fort Phoenix on the east side of the mouth of the Acushnet River, the port grew in stature as a noted rendezvous for Boston and Providence's Continental privateers that brought their prizes and unloaded their cargoes there (Pease and Hough 1889). As a result of this privateering activity and recognizing the value of New Bedford's significant commercial storehouses along its waterfront, British forces focused on New Bedford as a high priority target for attack and retribution (Howland 1907).

On September 5, 1778, a British fleet composed of two frigates, an 18-gun brig-of-war, and 36 transports carrying about 5,000 regular British army and naval troops commanded by Major General Charles Grey launched an attack on New Bedford and Acushnet and the vessels within the harbor. With most of the area's fighting-age men away to participate in battles being fought in Rhode Island and elsewhere, the port had few defenders. Those left behind mounted a defense, losing three with nine wounded in the process of killing nine British troops and causing 32 to go missing. Ultimately, the Continental defenders proved outmatched by the vastly superior numbers of the attacking British force. At the time of the attack, the inner harbor of New Bedford was described as being full of "all sizes and descriptions of vessels: fishermen, merchantmen, whalemen, privateers and prizes" (Howland 1907).

Landing at Clark's Cove on the southwest corner of the entrance into New Bedford Harbor, the British force marched to the river and then northward up its west side, across its head through the village of Acushnet, and then southward down its east side to the fort, before finally retiring to Sconticut Neck where they re-embarked upon their vessels. Facing comparatively light resistance, the British force put a torch to the port and burned houses, barns, stores, and mills, as well as buildings associated with the fort. They also torched the large number of vessels tied up at the wharves and at anchor within the harbor (although there were apparently some vessels "lying in the stream," and small craft up the river, that proved inaccessible and were undamaged) (Hurd 1883). An inventory of the property destroyed as a result of the attack was reported at the time by Major General Grey in his official action report on the engagement submitted to his commander, General Sir Henry Clinton, as "the vessels and stores in the whole extent of Acushnet River (about six miles), particularly at Bedford and Fairhaven." These properties included:

- Ten homes (two in New Bedford, six in Acushnet, and two in Fairhaven)
- 20 storehouses filled with large quantities of rum, sugar, molasses, tea, coffee, medicines, tobacco, gun powder, sail cloth, cordage, etc.
- Two large ropewalks
- Eight vessels from 200 to 300 tons, most of them prizes, nine armed vessels carrying from 10 to 16 guns, and 70 sloops and schooners of "inferior size," as well as an indeterminate number of whale boats and other small boats (Howland 1907).

Local resident, Gilbert Russell, cited by the historian, Ricketson (1858), reported a total of 34 vessels destroyed between Oxford Point and the old wharf at Belleville (known then as "McPherson's Wharf" and situated on the same side of the river and short distance away from the find-site of NBHSS UAD SW#2). The 34 vessels Russell reported as destroyed included seven ships, one bark, one snow, eight

brigs, seven schooners, and ten sloops (Ricketson 1858; Crapo 1840). These 34 vessels were identified as:

- ship *Harriet*
- Continental ship *Mellish*
- ship *Leopard*
- ship *Fanny* (French prize)
- ship *Heron*
- ship *Spaniard*
- ship *Caesar*
- bark *Nanny*
- snow *Simeon*
- Continental brig *Sally*
- brig *Rosin*
- brig *Sally* (fishing vessel)
- schooner *Adventure*
- Continental schooner *Loyalty*
- sloop *Nelly*
- sloop *Flying Fish*
- sloop *Captain Lawrence*
- schooner *Defiance*
- brig *No Duty on Tea*
- schooner *Sally* (*Hornet*'s prize)
- sloop *Bowers*
- sloop *Sally* (12 guns)
- brig *Ritchie*
- brig *Dove*
- brig *Holland*
- sloop *Joseph R.*
- sloop *Bociron*
- sloop *Pilot Fish*
- schooner *The Other Side*
- brig *Sally*
- sloop *Retaliation*
- sloop *J. Brown's*
- schooner *Eastward*
- schooner *Captain Jenny*

At least several of these vessels that were sunk at and off of McPherson's Wharf were reportedly "got up" (i.e., raised by divers from the harbor floor) shortly after the attack (Hurd 1883).

Given the large number of eighteenth-century vessels burned and sunk in the Acushnet River during the September 5, 1778 attack, as well as the evidence of burning in the NBHSS UAD SW#2's recovered hull timbers and the proximity of NBHSS UAD SW#2's find location to the Belleville section of New Bedford, archival research conducted for this study indicated that it is possible that, like NBHSS UAD SW#1, NBHSS UAD SW#2 was among the vessels destroyed during the British attack.

Following the Revolutionary War, the port of Greater New Bedford's economy and its whaling industry slowly revived, although several years passed before any new vessels were fitted out there. As of 1785, only eight vessels were registered in the port, several of which were engaged in whaling (WPA 1940). By the 1790s, New England's whalers were heading into the Pacific Ocean for the first time in search of their quarry. At the turn of the nineteenth century, the total number of vessels calling New Bedford home had risen to 51, and the whaling industry was starting to flourish again, as New Bedford and Fairhaven competed with Nantucket's whaling interests on their way to the former's eventual world dominance of the industry. As the scope and complexity of whaling grew, New Bedford's whaling-related ancillary maritime industries, such as shipbuilding, ropemaking, and spermaceti candle-making, all expanded as well.

In addition to whaling, merchants also began shipping cargoes out of New Bedford again. By 1802 there were 20 square-rigged merchantmen sailing from New Bedford to New York, the West and East Indies, and southern European ports. By 1805, the port boasted seven commercial wharves and 145 registered vessels, 65 of which were ships (12 of which were whalers) averaging 250 tons each. The remaining vessels were schooners, brigs, sloops and barks (Ricketson 1858; WPA 1940).

Given the long history of commercial maritime activity and shipping in the Acushnet River and New Bedford harbor, archival research also indicated that it was possible that NBHSS UAD SW#2 was a

merchant vessel that was abandoned at the end of its service life and left derelict in the less-active and less-developed upper reaches of the Acushnet River at the end of its service life. However, the archaeological evidence visible in the recovered timbers, described in detail below, seems to counter this possibility.

Analysis of documented shipwrecks included in Cox, Jr. (2000) (compiled from MBUAR's shipwreck list and the reported vessel casualties published in Berman [1972]), as well as an online query of NOAA's AWOIS, a review of the shipwreck list published in Fish (1989), the analysis of the New Bedford Whaling Museum Research Library's photographic archives involving the viewing of hundreds of images associated with the keyword searches "Acushnet," "Shipwreck," "Fairhaven," "Marsh," "Hulk," "Derelict," "Waterfront," "Wreck," and "New Bedford Shipwreck," a review of the New Bedford Public Library's Special Collections' Newspaper Database and the results from keyword searches of "Acushnet River," "Acushnet River Shipwreck," "Acushnet River Wreck," "New Bedford Harbor," "New Bedford Harbor Shipwreck," "Old Shipwreck," "Ship Burned," "Derelict Ship," and "Abandoned Ship," and a review of notes from interviews with the chair and senior members of the Acushnet Historical Commission, all produced no evidence of a likely candidate that could be NBHSS UAD SW#2. ***Consequently, based on the archival research conducted for this study, the identity of the vessel and its service history remain unknown.***

3.2 Archaeological Research Results

A total of 17 rounded cobbles/small boulders, thought to be possible ballast stones, and 36 wrapped timber packets, comprising a total of 50 individual pieces of wood, were examined and documented by DSRA over 10 working days spread over a nearly four-month period between October 7, 2017 and February 3, 2018. Hull timber types represented in the recovered assemblage of NBHSS UAD SW#2's remains included: three fragments of the keel shoe; the fully-preserved keel (separated into two sections formerly joined in a single flat-nibbed scarf); a large stern knee; a lower section of the inner stem; 10 floors; five futtocks; three garboard hull planking fragments; four hull planking fragments; one intact wooden hull sheathing plank and multiple sheathing plank fragments; and a miscellaneous unidentified timber (possibly a stern deadwood timber). Unlike NBHSS UAD SW#1, no artifacts were observed or collected during the NBHSS UAD SW#2 recovery or documentation operations. The documentation task comprised the bulk of the marine archaeological work that was done on NBHSS UAD SW#2 with thousands of measurements and photographs recorded, multiple photomosaics of individual timbers produced, and 76 individual scale measured drawings made to create the visual catalog of NBHSS UAD SW#2's hull remains (see Appendices C and D). The brief narrative descriptions of individual hull components that follow are presented in approximately the same sequence in which they were assembled during the construction of NBHSS UAD SW#2. Although every effort was made to present this information as clearly and concisely as possible, because of the complexity of some of the timbers' shapes and the technical nature of these descriptions, the reader is encouraged to refer frequently to the photographs and drawings included in the appendices.

3.2.1 Fasteners

Documented fastenings employed in the joinery of NBHSS UAD SW#2's wooden hull components included wooden dowel-like "treenails," wedged treenails, iron bolts, iron spikes, and iron and wood sheathing nails (**Figure 11**). As described above, only the treenails (and a small number of the wood sheathing nails) were extensively preserved. Dimensions and spacing patterns of the hull's iron fasteners are inferred from corroded remains, fastener holes, and corrosion stains that were visible in individual hull timbers.

The treenails used in the construction of NBHSS UAD SW#2 measured 1.2 in (3 cm) in diameter, were hexagonal in section, had ends sharpened into blunt points, and, in some cases, were wedged at their heads with thin wooden wedges or smaller faceted dowels inserted into their exterior ends to expand their heads and increase the tightness of their fit in their pre-drilled sockets. Treenails were used to fasten hull planking to floors, futtocks, and other hull framing members. It was observed that most of the treenail-fastened joints appear to have held fast, up until the time that NBHSS UAD SW#2 was disturbed at the time of its discovery and subsequently when it was dismantled during its recovery. Evidence of this was visible in the fresh breaks in framing timbers and planks at treenail locations and in the treenails, themselves.

With exception of the wooden treenails and small wooden sheathing nails (the latter of which were used with iron nails to secure NBHSS UAD SW#2's sacrificial wooden hull sheathing to the outside of the vessel's hull) (**Figure 12**), all of the remaining fasteners in NBHSS UAD SW#2's hull timbers were made from wrought iron and consisted of bolts, spikes, and nails. The bolts, 0.8 in [2 cm] round in cross-section and likely clenched with a washer at their ends, were used to secure each floor timber to the keel with one centrally located bolt per floor. Bolts were also used to secure the scarf joint in the keel, as well as the joints between the keel and the stem, sternpost, and deadwood. Spikes were used to temporarily fasten hull planking to the frames prior to the drilling of holes and driving of treenails into them, and to help secure the hooding ends of hull planks to the sternpost, the frames, and, presumably, the stem. The spikes used in NBHSS UAD SW#2 measured 0.4-inch-square (in^2) (1 -centimeter-square [cm^2]) in section, at their heads. Small iron and wood nails were used to fasten wooden hull sheathing to the exterior of the keel and the outside of the hull planking. The iron sheathing nails were rectangular in section and measured 0.1-x-0.2 in (3-x-4 millimeters [mm]), at their heads. The wood nails had rectangular heads and rounded shanks that tapered from a maximum diameter of 0.2 (4 mm) to a thorn-like point. DSRA knows of no other documented archaeological example of wooden sheathing nails in the nautical archaeological literature.

3.2.2 Keel Shoe

As in the case of NBHSS UAD SW#1, the bottom of NBHSS UAD SW#2's keel was protected from damages caused by groundings while operated in shoal waters by a series of heavy planks, butted end-to-end and attached to the keel's bottom surface, collectively termed a "false keel," or "keel shoe" (see Appendices C and D). While the presence of a keel shoe on the keel of NBHSS UAD SW#1 had been inferred from the anomalously excellent surface condition of, and pattern of fastener holes in, its bottom, a majority (72 percent) of NBHSS UAD SW#2's keel shoe was recovered intact. Broken into three fragments with a combined total preserved length of 36.2 ft (11 m), the NBHSS UAD SW#2 keel shoe had a measured thickness of 4.5 in (11 cm) and ranged from 9-11 in (22.5-28 cm) wide. It had been fastened to the bottom of the keel with 0.4 in^2 (1 cm^2) iron spikes, spaced (on average) 1 ft-6 in (0.5 m) apart, and distributed in a staggered pattern over its length. Two spikes positioned side-by-side were used to secure the ends of the keel shoe's plank sections. A total of three, widely and irregularly spaced, 0.8-in- (2-cm-) diameter, round iron bolt holes were also recorded in the keel shoe, perhaps indicating a few rare instances where holes for the iron bolts holding the floors to the top of the keel were unintentionally drilled too far, through the keel shoe. Residue of tarred "felting" (i.e., animal hair and pine tar), and numerous small nail holes noted on the sides of all three of the keel shoe fragments, together indicated the former presence of a protective layer of sheathing on NBHSS UAD SW#2's hull (described in detail below).

3.2.3 Keel

Evidence of NBHSS UAD SW#2's structural spine was preserved in three recovered hull elements: the "keel" (preserved over its entire length); the "inner stem" from the bow; and the "stern-knee" from the stern. These elements (and the keel shoe) would have been among the first hull components to be cut, shaped, and assembled on the stocks and defined the vessel's overall length between perpendiculars. The size and forms of these members were determined by the planned primary function of the vessel, economic concerns, specific construction requirements of the planned vessel type, the prevailing environmental conditions in the region of the vessel's construction and planned area of operation, the availability of materials, and the builder's working knowledge of shipbuilding theory and techniques.

NBHSS UAD SW#2's keel, composed of two joined sections, was cut from the heartwood of large trees and has a preserved overall length of 50.4 ft (15.4 m) (see Appendices C and D). Scalloping from the shaping or "dubbing" of the timber with an adze was visible in portions of the keel's surfaces (**Figure 13**). The keel tapers (i.e., gets smaller in size) from bow-to-stern with a measured "sided" dimension (i.e., the width of a ship's heavy timber) ranging from 11-9 in (28-22 cm), bow-to-stern, and a "molded" dimension (i.e., the height of a ship's heavy timber) ranging from 14-9.5 in (35-24 cm), bow-to-stern. The keel was assembled in two sections that were flat-nibbed scarfed together at a point about two-thirds of the way along the hull's length from the bow, similar to the way in which the keel of NBHSS UAD SW#1's keel was fashioned (**Figure 14**). The diagonal keel scarf's table measured 6 ft (1.8 m) across and (viewed in profile) sloped downward from bow-to-stern. The nibbed ends of the keel scarf had molded dimensions that measured 2 in (5 cm) (bottom nib) and 4 in (10 cm) (top nib). The keel scarf joint had been secured by six iron bolts, 0.8 in (2 cm) diameter, round in cross-section, and likely clenched with a washer at their ends. The nibbed ends of the scarfed keel sections had been fastened with two 0.4 in^2 (1 cm^2) iron spikes positioned side-by-side. The joint was fitted with two, 1.2-in- (3-cm-) diameter treenail-like "stop-waters" (i.e., wooden pins oriented horizontally and perpendicular to the axis of the keel, whose purpose was literally to stop water on the outside of the hull from following the seam of the joint between two timbers and seeping inside the hull). One stop-water was preserved in its original position at the base of the top (i.e., forward) keel scarf nib (see Figure 14). Matching semi-circular grooves cut into the middle of each keel section's scarf table surface, so that when joined they formed a circular hole, provided evidence for the former presence of a second stop-water in the keel scarf joint (see Figure 14).

A 'V'-shaped rabbet was cut into the keel's upper corners to accommodate the lower edge of the lowest run of hull planking (termed the "garboard strake") that had been attached to both sides of the keel along its length. Within the rabbet was a flattened fibrous material that is likely "junk-hemp" caulking.

Viewed in profile, the upper surface at the forward end of the keel slopes slightly downward, to accommodate other elements of the ship's stem assembly, while the bottom surface of the keel's forward end is cut at an upward angle to create a joint between the keel and the inner stem. A single semi-circular groove cut athwartships into the table of the keel-inner stem joint matches a similar groove cut into the adjoining surface of the inner stem, which when combined created a 1.2-in- (3-cm-) diameter hole that once held a stop-water. The keel-inner stem joint was secured by five, 0.8-in- (2-cm-) diameter round iron bolts, three of which are distributed in a line, and two that are positioned side-by-side at the keel's forward end.

As mentioned briefly above, the top surface of the keel is penetrated by holes drilled to accept 0.8-in- (2-cm-) diameter, round iron bolts at 23 locations distributed along the center of the keel's length and spaced between 1.5 and 2 ft (49 and 66 cm) apart. These holes correspond to the former locations of the hull's lowermost "rib" or "framing" elements, termed "floors," that were oriented perpendicular to and across the top of the keel to which they were once fastened. The holes are an important clue to the total number of floors that once spanned NBHSS UAD SW#2's hull.

Square (0.4 in^2 [1 cm^2]) iron spike holes in, and the anomalously excellent condition of, the keel's bottom surface provided correlating evidence for the former presence of a keel shoe (described above). Residue of tarred felting and numerous small rectangular fastener holes for sheathing nails, distributed in a generally diagonal pattern visible on the sides of the keel, indicate that the vessel's hull was covered in protective sheathing that had once extended down to and covered the sides of the keel. A comparison of NBHSS UAD SW#2's keel dimensions with those of NBHSS UAD SW#1 revealed that they were of generally similar size (see Table 1). Although the overall length of NBHSS UAD SW#2's keel is 6 ft (1.8 m) shorter than the length of NBHSS UAD SW#1's keel, the vessels' keels only vary 1-2 in (2.5-5 cm) from each other in their sided and molded dimensions.

3.2.4 Inner Stem

The lower portion of an "inner stem" was recovered from the forward end of NBHSS UAD SW#2's hull remains (see Appendices C and D). Consisting of a single, partially-preserved, heavy timber that was formerly situated low in the bow, the inner stem is the hull element that would have connected the horizontal structure of the keel's forward end with the more vertically-oriented stem assembly (**Figure 15**). The upper preserved limit of the inner stem ends in an eroded and marine organism-damaged break approximately 5 ft (1.5 m) above its heel. From its heel to its uppermost limit of preservation, the inner stem tapers in its sided dimension, from 8-5.5 in (20-14 cm), and from 14-8 in (36-20 cm) in its molded dimension. In profile, the transition from the horizontal orientation of the keel to the more vertical orientation of the inner stem forms a 35-degree angle from horizontal. The lower aft or inboard face of the inner stem is cut at an angle to join the forward end of the keel, as well as a deadwood or apron timber, which were not among the recovered hull remains. Scalloping from shaping the timber with an adze was visible in surfaces of the inner stem's sides.

3.2.5 Stern Knee

A large, roughly-hewn, compass timber, consisting of a portion of a tree trunk and one of its branches, forms a complexly shaped, completely intact, "stern knee" that was recovered from NBHSS UAD SW#2's aft hull remains (see Appendices C and D) (**Figure 16**). The purpose of the stern knee was to strengthen the connection between the top surface of the aft end of the horizontally-oriented keel and the forward surface of the more vertically-oriented sternpost assembly. The larger and longer horizontal arm of the stern knee that was fastened to the top of the keel measured 6 ft (1.8 m) long and was 13 in (32 cm) molded at its forward end, and 16 in (40 cm) molded at the knee's throat. The sided dimensions of the horizontal arm of the stern knee tapers from bow-to-stern and from top-to-bottom. The top surface of the horizontal arm of the stern knee's sided dimension ranged from 14-6.3 in (36-16 cm), bow-to-stern, while its bottom surface's sided dimension ranged from 5.5-4 in (14-10 cm), bow-to-stern. The vertical arm of the stern knee measured 3 ft (91 cm) long and forms an aft-raking 65-degree angle from horizontal. The sided dimension of the stern knee's vertical arm is a uniform 8 in (20 cm) from bow-to-stern and tapers from 7.5-4 in (19-10 cm) head-to-heel. Dados (3 in [8 cm] deep and 6 in [16 cm] sided) are notched 1-2 in (2.5-5 cm) into either side of the top corners of the stern knee's horizontal arm at two locations to accommodate the lower, inboard ends of two sets of "half-floors" (i.e., floors that do not fully cross over the top of the keel). Six, 1.2-in- (3-cm-)

diameter treenails are fastened through the stern knee horizontally. It is not clear to what these treenails were fastened. Charring is visible in the top surface at the forward end of the stern knee's horizontal arm.

3.2.6 Floors

Slightly less than half (i.e., 10) of NBHSS UAD SW#2's estimated 23 floors (a total indicated by bolt holes in the top of the keel) (plus two "half-floors") was found preserved in the recovered hull remains. All 10 of the recovered floors were shaped primarily from compass timbers using an adze, and appeared to derive from the aft half of the hull (see Appendices C and D). All of the floors exhibited charring and damage from burning on their upper surfaces and sides (**Figure 17**). Based on the measured locations of the bolt holes distributed along the length of the keel, floors were fastened to the keel at an average, on-center spacing of 22 in (56 cm). Spacing between the floors and the adjoining next element of the frames, termed "first futtocks," could be inferred from measurements of fastener hole patterns and preferentially preserved raised areas corresponding to where floors and futtocks were in contact with the inboard surfaces of the garboard and first planking strakes. This patterning suggested that a tight (in places), although somewhat variable, spacing between the floors and first futtocks had existed before these components were separated at the time of NBHSS UAD SW#2's discovery and during the recovery of its hull remains.

NBHSS UAD SW#2's 10 recovered floors measured between 2.6-8 ft (80 cm-2.4 m) in their preserved lengths. Molded dimensions of the floors ranged from between 8-12.6 in (20-32 cm), measured at the floor's throats (i.e., their centers). Sided dimensions of the floors ranged from between 6.7-8.7 in (17-22 cm). Limber holes measuring about 3 in (8 cm) wide and 1.5 in (3.8 cm) deep were cut into the bottom faces of the floors on either side of the keel. The ordering of the 10 recovered floors along the keel was determined by comparing their angles of deadrise.

3.2.7 Futtocks

Six partially preserved futtocks measuring between 2.6-3 ft (78-94 cm) long with molded dimensions of 4.7-6.3 in (12-16 cm) and sided dimensions of between 6.3-8 in (16-20 cm) were recovered from NBHSS UAD SW#2 (see Appendices C and D). The futtocks appear to represent the first, or lowermost, futtocks of the hull's now-disassembled floor and futtock frame components. All of the futtocks have hexagonal (in section) treenails or treenail holes. Treenails were used to fasten the hull planking and futtocks together. The limited number of recovered futtocks and floors with horizontal treenails indicated that the floors and futtocks were not uniformly "articulated," or fastened together, as was the case in the "double-sawn" framing typical of wooden vessels built in the middle nineteenth century and later. All of the futtocks are charred on their upper surfaces.

3.2.8 Miscellaneous Timber

A single timber tentatively identified as part of the stern deadwood was recovered from NBHSS UAD SW#2's hull remains (see Appendices C and D). The piece measured 5.4 ft (1.7 m) long, (16-31 cm) molded, and 5.5-6.3 in (14-16 cm) sided. At what appears to be its heel, the timber is cut at a 40-degree angle, which does not match the 65-degree aft rake of the stern knee, making its identification as part of the stern deadwood less certain. Evidence of charring is visible at its uppermost preserved end. Three square holes in the timber's fore-and-aft edges were formerly filled with 0.4 in^2 (1 cm^2) iron spikes.

3.2.9 Hull Planking

A total of 7 hull planking fragments were recovered and documented from NBHSS UAD SW#2's hull remains (see Appendices C and D). Four of these fragments were from the garboard strake, one fragment was from the first planking strake (i.e., the first run of planking above the garboard strake), and two were partial-width planking fragments from either the garboard or first planking strake. The four garboard strake fragments ranged from 3.9-13.5 ft (1.2-4.1 m) long, 16-18 in (40-45 cm) wide, and 2 in (5 cm) thick. The lone, first planking strake fragment measured 12.6 in (32 cm) wide and 2 in (5 cm) thick. The hull planking had been fastened to the ship's frames with treenails (generally two treenails per frame location). Holes for the iron spikes, which appeared to be distributed randomly at frame locations, that had been used to temporarily hold the hull planking in place prior to the installation of treenails were visible as well in the hull planking fragments. The four garboard strake fragments were identifiable by their lower beveled edge that would have fit into the rabbet cut into the upper corners of the keel, thus indicating that they were from the lowest run of planking in the ship's hull. Fastening patterns on the garboard strake indicate that the lower edge of the garboard was treenailed into the upper ends of the floors (one treenail per floor), while its upper edge was treenailed into the lower ends of the first futtocks (one treenail per futtock). The treenail fastening pattern in the first planking strake was uniformly two treenails per futtock. The hooding ends of the hull planking had been fastened underlying framing with two, 0.4 in^2 (1 cm^2) iron spikes and one treenail. Surface features observed in the planks included two roman numeral scribe-marks ("XX" and "XXV") at the ends of two of the garboard strake fragments, and saw marks that are clearly those associated with hand-cut "pit" sawing. These saws were in common operation in England's North American colonies and, later, the United States, from the late 1630s to the middle-nineteenth century (especially in smaller, more rural shipyards during the latter end of the time range) (**Figure 18**). Tarred felting residue and numerous small sheathing nail holes present on the outboard surfaces of the hull planking provided additional evidence of the use of hull sheathing.

3.2.10 Hull Sheathing

Whereas the use of wooden hull sheathing in the hull of NBHSS UAD SW#1 had been inferred from the presence of sheathing nail holes in the outboard surfaces of the hull planking and the absence of cuprous sheathing nails, cuprous corrosion staining, or embedded cuprous sheathing fragments, in the case of NBHSS UAD SW#2, two nearly intact wood hull sheathing planks and three fragments were actually present among its recovered hull remains (see Appendices C and D). The largest of the nearly intact hull sheathing planks measured 17.4 ft (5.3 m) long, 13.4 in (34 cm) wide, and 0.8 in (2 cm) thick, while the smaller nearly intact sheathing plank measured 7.5 ft (2.3 m) long, (33 cm) wide, and 0.6 in (1.5 cm) thick. Surface features on the hull sheathing's inboard surfaces included widely-spaced (0.5-0.7 in [1.2-1.8 cm]) and irregularly angled saw kerf marks consistent with hand-cut pit or "platform" sawn lumber (**Figure 19**) (as was also seen in the outboard surfaces of the hull planking), as well as large areas of intact tarred felting still attached to the hull sheathing planks. Visible on the outboard surfaces of the hull sheathing were the numerous holes for the 0.01-x-0.02 in (3-x-5 mm) (rectangular in section) sheathing nails. In the largest of the nearly intact hull sheathing planks, a total of 156 sheathing nail holes were counted and their locations plotted in the scale drawing of the plank to record a representative sample of their patterning and spacing. Also visible on the outboard surfaces of some of the hull sheathing fragments was a brown mustard-colored paint residue. It was not clear whether the color was original or had been white and then stained by exposure to a combination of adhering sediments and iron corrosion.

3.3 Analyses Results

As in the case of the marine archaeological investigation of NBHSS UAD SW#1's hull remains, a review of Van Horn's (2004) synthesis of historical and archaeological information on shipwrecks of eighteenth century British and North American colonial vessels, which included 10 merchant vessels, provided the single-best source of comparative data useful for determining the relative age, possible nationality, size, and vessel type of NBHSS UAD SW#2. Van Horn (2004) identifies in her thesis several key factors that influenced ship design and construction during the period:

1. The transition in British merchant ships from defensive-style ships to bulk carriers that occurred in the late seventeenth century that resulted in both types being still in use at the beginning of the 1700s.

2. The timber shortage in Europe, the comparative abundance of timber in the New World, and the effects on the materials that were available to shipwrights for vessel construction, as well as the impact of the growing costs of compass timbers and its potential limitation on their use in merchant vessels where economy was essential.

3. The need to economize more in the construction of merchant ships than in naval vessels, where standardization took priority, greater hull strength was necessary for carrying heavy armament and deflecting enemy shot, and governments were better able to pay for higher quality construction than merchant owners.

4. The overall increase in vessel size over time and the fact that British merchant vessels were generally larger than colonial craft.

5. Potential distinctions between British and colonial vessels based on inferred trade networks and cargoes as well as the increasing need for speed during and after the Revolutionary War.

Absent of finding a cargo on a shipwreck site, general inferences from hull size and shape may be used to interpret the purpose and trade(s) for which vessels, such as NBHSS UAD SW#2, was built. First, Van Horn's synthesis of archaeological data recorded from the hull remains of the 10 merchant vessels included in her study indicated that none of these vessels was larger than 300 tons. In fact, 50 percent of the ships fell into a mid-size range of about 100 tons. Four of the five 100-ton ships (i.e., 80 percent) were American-built, suggesting that this size was the most common for American-built trading vessels in the colonies. Three of the four 100-ton American-built ships (75 percent) (i.e., the 1725 to 1750 *Rose Hill*, the pre-1765 *Reader's Point*, and the 1770's *Otter Creek* shipwrecks) were used in the inter-colonial and West Indies trades, and probably represent typical sloops and schooners used for colonial maritime commerce. British and colonial-built ships did diverge on a few points in terms of the types of timber used, the sizes of timber, and the sizes of the vessels. British transatlantic trading vessels were larger than the West Indies/inter-colonial traders. They also used a narrower range of wood types than employed in colonial-built vessels, which included any types specific to their local regions of build in the New World. Colonial-built ships also tended to use larger pieces of compass timber, whereas the British vessels attempted to conserve timber by breaking up typically large pieces into multiple smaller ones.

In the same way that intended use of the vessel influenced decisions about its size, the archaeological remains of the ten eighteenth century merchantmen shipwrecks studied by Van Horn (2004) indicate that hull shapes were also related to trade. The hull design for the majority of the vessels

serving as inter-colonial traders depended on whether the owner anticipated danger from attack, and, therefore, built the ship for speed and maneuverability to outrun pirates and privateers, or not. The latter type of vessel was constructed with a full-bodied hull shape to maximize cargo space at the expense of speed. Examples of the former are the 1779 Continental privateer, *Defense*, and the 1759 Lake Champlain warship, *Boscawan*, which have near amidships hull-sections exhibiting 20-degrees and 22-degrees of deadrise, respectively. Examples of the latter type of vessel are the three aforementioned 100-ton, American-built, West Indies/inter-colonial merchant ships including the *Rose Hill*, *Reader's Point*, and *Otter Creek* shipwrecks, which have near amidships hull-sections exhibiting 8-, 10-, and 13-degrees of deadrise, respectively (Van Horn 2004).

As was the case for NBHSS UAD SW#1, the hull remains of NBHSS UAD SW#2, as examined and reconstructed for this study, are consistent with those of the most ***common of the American-built trading vessels – a 60-70-ft- (18-21-m-) long, 90-100-ton sloop or schooner with a full, near amidships hull-section exhibiting between 6-10-degrees of deadrise - engaged in the transportation of cargo in the region's coastal inter-colonial trade.***

Additional historical and archaeological data provided by Van Horn (2004) regarding the types, dimensions, wood species, fasteners, and configuration of individual hull timbers of eighteenth-century shipwrecks provide further clues to the relative age, nationality, size, and vessel type of NBHSS UAD SW#2. As in the description above of NBHSS UAD SW#2's hull remains, the hull timber data presented below follow the same approximate sequence that the timbers would have been laid down and installed during a wooden vessel's construction. The characteristics of eighteenth-century vessels described below (and are summarized in Table 2 of this report) provide a technological context for interpreting the physical characteristics of NBHSS UAD SW#2's hull timbers that are presented in a narrative format in section 3.2 of this chapter and in the hull timber photographs and scale drawings in the appendices of this report.

Archaeological investigations of the remains of eighteenth-century shipwrecks performed to date indicate that keels varied in size and shape and could be made of a number of different wood types. White oak was the predominant choice for keels, as well as most other hull components, because of its widespread availability and greater durability, strength, and resistance to decay. Elm (*Ulmus*), hard maple (red maple and silver maple) (*Acer rubrum and A. saccharinum*) (prone to decay) and pine (*Pinus*) (a poor choice for a keel timber) were also found in the keels of the investigated vessels in the 2004 Van Horn study. The keels of these vessels were most often composed of one or more pieces joined or scarfed end-to-end. The rabbet for the garboard or lowermost planking strake was usually cut into the upper corners of the keel.

The shape of the keel would have influenced the vessel's sailing ability with a deeper keel helping to prevent lateral drift and a shallower keel providing better access to shoal waters. A false keel or keel shoe (a sacrificial shoe attached to the bottom of a keel to protect the keel from damages resulting from groundings), such as that found in the hull remains of NBHSS UAD SW#2 (and inferred to have been present in NBHSS UAD SW#1) seems to have been an optional element of eighteenth-century ships that was not consistently used.

In most of the archaeologically documented eighteenth century wrecks included in the Van Horn (2004) study, stem and sternpost remains were not well preserved. When present, these timbers would typically consist of a gripe or forefoot, the stem proper, and an apron in the bow, and a knee with deadwood and the sternpost at the stern. Preserved elements of NBHSS UAD SW#2's bow and stern conform to these typical findings.

Framing patterns exhibited in the archaeological examples examined by Van Horn (2004) present the best clues to the possible design methods used in the construction of a ship's hull. The frames may also reflect the vessel's trade and the availability of timber at the time and place of its construction, as well as shortcuts the builder took in an attempt to save costs. The most-costly timbers for shipwrights to purchase were "compass" timbers (i.e., timbers with naturally-grown shapes and curves that were fit to the design of the hull) and long, straight pieces, such as those used for keels. Attempting to economize was important for all merchant vessels, but American builders, with a plentiful supply of timber, probably focused more on economizing labor than materials. As mentioned above, although oak was the preferred wood for shipbuilding, many of the merchant vessels incorporated other types such as pine, maple, and even beech, because they were readily available in the New World. Timbers were occasionally left unfinished to keep them as large as possible and reduce the time required for completion. As in the case of NBHSS UAD SW#1, NBHSS UAD SW#2's recovered hull timbers included modified compass timbers, cut and hewn to shape.

All of the vessels in the Van Horn (2004) study had "squared double frames" (not to be confused with "double-sawn frames" typical of nineteenth century wooden ship construction) that were placed square to the keel throughout the run of each hull, whereas the extreme ends of the hulls showed a mixture of framing techniques that included "square" frames and "cant" frames. The framing of all the shipwrecks studied by Van Horn was almost entirely of white oak (*Q. alba*). Dimensions of the frames varied with intended use and matched the overall scantlings of the vessels. The more heavily built merchantmen had large floor and futtock timbers with frames spaced closely together in some cases. In other cases, lighter, more widely spaced frames were used to reduce building costs and improve sailing performance. In the American-built, 100-ton West Indies/inter-colonial merchantmen, dimensions varied significantly between timbers and the frames were often unevenly spaced (Van Horn 2004).

The late seventeenth-century Phips wreck, the earliest of the merchant ships examined by Van Horn (2004), had futtocks without any horizontal joinery that were separated by gaps of varying size. These spaces and the lack of joinery suggest that the floors were installed first, with futtocks added as the hull was planked. The futtocks also clearly showed a lack of standardization, as the dimensions varied greatly and some of the timbers still had cambium and bark attached to them. In addition, to make the timbers thicker near the centerline and reduce the need for compass timbers, bottom and top fillets of wood were used, in a somewhat similar manner as that which was found in the floors of NBHSS UAD SW#1. The wrecks of the late seventeenth-century Port Royal warship and the mid- to late-eighteenth-century Town Point vessel examined by Van Horn (2004) also had only disarticulated frames. For all of these vessels lacking articulated frames, the complete frames could not have been assembled prior to their installation on top of the keel, but would have, instead, been placed piece-by-piece as the hull was planked. After all the floors were installed, the second and fourth futtocks (if used) could be joined to the floors of the master frames, but the first and third futtocks could not be installed until the planking was attached. Alternatively, it is that no mold frames were used and timbers were added by eye and shaped using ribbands. This method of using only disarticulated frames could save time and money during construction, as the timbers did not need to be carefully shaped to fit closely together. Pieces could be left closer to their original shapes, requiring smaller compass timbers to meet the necessary size requirements. The preserved framing of NBHSS UAD SW#2 exhibited square double frames with just 2 of the 10 (20 percent) recovered floors showing signs of a former articulation with futtocks (i.e., horizontal treenails), and none of the 6 recovered futtocks showing any signs of articulation with floors or other futtocks. Evidence for minimal articulation of NBHSS UAD SW#2's framing elements is also seen in the inboard surfaces of the recovered garboard and hull planking fragments where their surfaces are raised in the places where they were in contact

with and protected from wear by the hull framing. In the preserved garboard fragments where clues of framing patterning were preserved, just 4 of 15 (27 percent) of the floor and first futtock pairs appeared to have been articulated. In the single recovered hull planking fragment (i.e., likely from the planking strake just above the garboard strake), futtock patterning preserved on the inboard surface of the plank fragment indicates that none of the futtocks appear to have been articulated.

Attempts to delineate a pattern of framing evolution over the course of the eighteenth-century have not yet resulted in the recognition of any obvious patterns, although most of the earliest vessels did have only disarticulated frames, and frames over the entire period were almost always double, with a floor and associated futtock arranged side-by-side.

While there may have been some type of transition from disarticulated to articulated frames during the course of the period, the most common framing method appears to have been the use of regularly spaced mold frames with intermediate filler frames. Double frames appear to have been the standard throughout the period. Spacing between frames generally was small, but varied widely. The earlier vessels appear to have had less space between frames than later vessels (Van Horn 2004). Evidence of NBHSS UAD SW#2's framing patterning, preserved in the inboard surfaces of some of its recovered garboard fragments and single hull planking fragment, indicated, at the garboard strake level, an average floor spacing of 20 in (50 cm) on center with an average of 3.5 in (8.6 cm) of room or space between the framing (exclusive of the 4 articulated frame locations where there was no space between the floor and first futtock). At the hull planking level, the average spacing of futtocks was 10 in (25.7 cm) on center with an average of 3.7 in (9.3 cm) of room or space between them.

In addition to providing clues to ship design, the frames indicate the quality of timber used for construction, whether this choice was based on expense or availability. Using frames of smaller scantling, spacing frames farther apart, and canting timbers in the extreme ends were all ways to reduce the costs of timber. Top and bottom fillets, as seen on the colliers included in Van Horn's 2004 study, allowed smaller pieces of compass timber to be used by the ships' builders. As compass timbers were the most expensive wood used in ship construction, reducing their needed size produced a large cost advantage (Van Horn 2004). While bottom fillets had been used in the flooring of NBHSS UAD SW#1, they were not present on any of the recovered floors from NBHSS UAD #2. Likewise, there was also no evidence for the use of cant frames in NBHSS UAD SW#2, which were present and documented in the recovered remains of NBHSS UAD SW#1.

Framing the extreme ends of a wooden vessel was often a difficult task, because of the severe curvature of the hull and planking at those points. Two main methods for dealing with this problem are seen in the eighteenth-century archaeological examples included in the 2004 Van Horn study: either: 1) square frames (i.e., frames oriented perpendicular to the longitudinal axis of the hull) to the very ends of the hull with vertical hawse pieces running parallel to the keel supporting the planking near the posts; or 2) frames that were canted or angled to remain flush with the planking. The former method required a large bevel for the timbers to let the planking run smoothly and used an excessive amount of timber in order to avoid exposing the timber's rot-prone sapwood. In some cases, the shipwright developed a variation of one of these techniques in an attempt to improve them. Unfortunately, in many of the eighteenth-century shipwrecks included in the Van Horn (2004) study, the frames in the extreme bow and stern do not survive or could not be examined, thus limiting the amount of available evidence for comparison with the remains of NBHSS UAD SW#1 and NBHSS UAD SW#2.

The wreck of the Reader's Point vessel, as well as the *Betsy*, and the *Nancy* all had obviously canted

frames. These timbers took the form of half-frames that were fastened directly to the planking after it was installed, but were not attached to each other or the centerline structure. In the Reader's Point vessel and the *Nancy*, the cant frames were only apparent in the bow, whereas in the *Betsy* they were clearly used in both bow and stern. In all three vessels some of the timbers came to a wedged point before touching the apron, while the other frames butted against it (Van Horn 2004).

Both framing styles were used in the bows and sterns of the various vessels included in the Van Horn (2004) study; however, there was no clear differentiation based on the vessel nationality. The earliest clear examples of cant framing is seen in the wrecks of the *Boscawen* and the Reader's Point vessel, dating to just after the middle of the eighteenth-century. The earlier shipwrecks of the Ronson ship and the Rose Hill sloop had square frames in their bow and stern, although square framing of the bow and/or stern of ships does continue later in the period as evidenced by the Deadman's Island sloop and Town Point vessel from the last quarter of the eighteenth century. Regardless, the examples do suggest that cant frames were a later development than square frames (Van Horn 2004). The dados for squared half-floors cut into the upper corners of the long horizontal arm of NBHSS UAD SW#2's stern knee, and the absence of recovered cant frames from NBHSS UAD SW#2 suggest that, unlike NBHSS UAD SW#1, it may have been built without them.

The planking of the eighteenth-century vessels included in the 2004 Van Horn study was typically attached to the frames with wooden treenails, which were either wedged or un-wedged, and iron spikes. Treenails were the main type of fastener utilized on all but two of the vessels, which used iron nails almost exclusively, instead. This deviation from the common pattern may indicate that craftsmen without formal training in shipbuilding constructed these vessels; alternatively, the choice could have been made to save expense or time, as large auger-drilled holes were required for treenails. Treenails (wedged and un-wedged) were used in the hull-construction of both NBHSS UAD SW#1 and NBHSS UAD SW#2. As noted above, the species of timber employed for the planking in most of the vessels was white oak, although red oak (*Quercus rubra*) and pine were also used. External and ceiling planking thicknesses were fairly consistent, averaging 1.5 to 3 in (3.8 to 7.6 cm) for the larger vessels and 1.1 to 1.3 in (2.8 to 3.2 cm) for the riverine craft. In the archaeological examples, the 100-ton merchant vessels with inner and outer planking used planks of about 2 in (5 cm) in thickness (Van Horn 2004). Planking thicknesses in the recovered garboard and hull planking fragments from both NBHSS UAD SW#1 and NBHSS UAD SW#2 measured 2 in (5 cm).

In addition to the standard practice of caulking the seams of outer hull planking on wooden ships to prevent leakage, additional protection from damages from groundings or attack by wood-boring mollusks (i.e., the "shipworm" [*Teredo navalis*]) was provided to the hull by sheathing it in a thin, sacrificial skin of wood or, later, metal (e.g., copper sheeting). The majority of the eighteenth-century shipwrecks included in the 2004 Van Horn study had some type of coating and wood sheathing to protect the hulls from shipworm. Pitch or pine tar was usually combined with animal hair or felt and layered over the outside of the hull to prevent worms from penetrating the hull. Some type of wood or metal sheathing was then placed over the anti-worm coating to protect it and keep it in place. Wood sheathing or "sacrificial planking" was found on six of the 10 (60 percent) merchant vessels included in the Van Horn study. Sheathing was typically attached to the outer planking with small iron tacks or nails. The most common wood-type used for the sheathing was pine, although white oak was also used, as was used on the keel (only) of the Reader's Point vessel. Oak may have been chosen for this vessel, because its keel was made from maple, which is more susceptible to rot than oak. The only other vessel reported to have sheathing on the keel was the *Betsy*, the posts and rudder of which were sheathed, as well. Sheathing varied widely in its thickness, ranging from 0.25 in (0.6 cm) on the Reader's Point vessel to 1.25 in (3.2 cm) on the *Betsy*. The thickest sheathing was on the

two colliers and the Otter Creek wreck, all heavily-built in their other scantlings, as well. As most of the vessels had sheathing, it appears to have been a standard element on merchant ships of the period, especially for those engaged in the trans-Atlantic and West Indies trades. No mention was made of sheathing in the excavation reports of the Phips wreck, the Terence Bay vessel, or *Defence*; as these three were all built and operated in cold New England waters, it seems likely they would not have needed it (Van Horn 2004). Since copper sheathing did not become common on merchant vessels until the nineteenth century, it follows that only wood sheathing was present on the sheathed Van Horn study vessels. While the hull planking from NBHSS UAD SW#1 had clues that it had once been sheathed in wood, evidence of tarred animal hair felting and 0.6 in (1.5 cm) thick wood sheathing was present in abundance in the recovered remains of NBHSS UAD SW#2. A peculiarity of NBHSS UAD SW#2's sheathing was the use (although limited) of wood sheathing nails, in addition to the more commonly used iron sheathing nails. No other archaeological example of their use is known. Although no microscopic wood-species analysis was done as part of this project, the wood used for NBHSS UAD SW#2's sheathing appears to be that of a softwood, such as pine or fir.

While a ship's size, shape, and hull timbers can be indicators of a vessel's purpose as either a trans-oceanic, coastal or riverine trader, elements of the ship's equipment, such as the presence of a cookstove, can also be such an indicator. A cookstove was an essential feature for vessels intending to spend prolonged periods away from the shore. Coastal or riverine traders could potentially come ashore for cooking, but vessels making longer trading voyages, or involved in privateering, needed a way to prepare food while at sea. Two examples of cookstoves have been found on eighteenth-century shipwrecks: Rose Hill sloop and *Defence.* Most of the ships examined in the 2004 Van Horn study likely had some type of cookstove, but the item may have been salvaged or not preserved. The actual structures could be large and carefully built, or relatively simple. At a minimum, they would have consisted of a brick hearth fitted with a spit or cauldron for cooking over a fire. While there was evidence that NBHSS UAD SW#1had a brick-lined cookstove onboard, no such evidence was observed or recovered in the remains of NBHSS UAD SW#2. This absence suggests that NBHSS UAD SW#2 was not spending prolonged periods away from shore, and, therefore, more likely to be a coastal trader.

3.4 Conclusions and Recommendations

The July 2016 unanticipated discovery of NBHSS UAD SW#2, the remains of an historical wooden sailing vessel, encountered in the Acushnet River in the NBHSS's Upper Harbor area, and the response and subsequent marine archaeological recovery and investigation of this wooden vessel's remains, were performed on behalf of the EPA between July 2017 and September 2018, and enabled the NBHSS's required environmental remediation activities to proceed while preserving important information about a rare and unique submerged cultural resource. The combined archaeological and archival research completed for this investigation suggests that, like NBHSS UAD SW#1, NBHSS UAD SW#2 dates from the late eighteenth century and likely represents the remains of a once-common class of ship – the 90-100-ton inter-colonial coastal merchant sloop or schooner. While research to determine the identity of the vessel was unsuccessful, determining the vessel's place in the developmental history of the port of New Bedford was more conclusive.

Archival research indicates that between 30 and 70 ships were burned and sunk by British forces during a 1778 attack on New Bedford Harbor, including in the upper Acushnet River, which was, at that time, an active part of the harbor. While the age, location, and charring of timbers suggest that, like NBHSS UAD SW#1, NBHSS UAD SW#2 could be one of the vessels that was destroyed by fire during the war, the absence of any artifacts or ship-related hardware that one would presume would have settled within the hull if it had been unexpectedly burned during an attack led initially to the same

conclusion that had been drawn for NBHSS UAD SW#1 – that is, that NBHSS UAD SW#2 was likely to be a vessel abandoned at the end of its service life, sometime in the early to mid-nineteenth century, and left derelict in the Upper Harbor, out of the way of the majority of the Harbor's activity at that time, where it was eventually vandalized and burned. Further consideration of the weight of combined archaeological and archival evidence provided by both the NBHSS UAD SW#1 and the NBHSS UAD SW#2 studies, however, now seems to align better with the original hypothesis – that both vessels were likely to have been casualties of the 1778 British attack.

The reasons are as follows. First, while both vessels showed signs of wear from use, and NBHSS UAD SW#1's stern post had been hacked at and damaged by vandalism that occurred post-deposition, neither vessel displayed significant signs of deterioration/damages, or extensive repairs that one might expect from a vessel at the end of its service life. Second, old vessels left derelict would likely have been in either a leaky condition or have had a hole or holes made through their hull planking to allow them to fill with water and settle to the harbor floor to keep them immobile and prevent them from drifting into and damaging the harbor's other vessels and infrastructure. In the case of both vessels, though, the extensive charring seen in the remains of NBHSS UAD SW#1 and NBHSS UAD SW#2 extends all the way down to the tops and sides of the floors, which are the lowest framing elements in the hull. If these vessels' hulls had been leaky and partially water-filled or submerged, it would have been unlikely or impossible for fire to reach down to and extensively char the tops and sides of the floors, which at their tallest points only extended 8-12 in (cm) above the inside surfaces of the lowest parts of the hull. Third, the absence of artifacts may be attributable to multiple causes, such as them falling through the rake-mesh on the machine's grabber, being hosed away or destroyed when timbers were sprayed with water to remove as much of the accreted contaminated sediments from the hull timbers as possible during recovery, being swept away by especially strong currents associated with regular Spring-thaw heavy river flow and moon tides, or by extremely powerful water flows and currents associated with the massive storm surges and wind-driven waves that have occurred on multiple occasions during the severe hurricanes that have hit southern New England over the last 200+ years. Finally, hull components and other items of value may have been salvaged from the vessels after they burned. Any one or combination of these scenarios is possible.

While NBHSS UAD SW#2's site was assessed as historically significant for its information potential, it is not National Register eligible, because of its lack of contextual integrity. The remediation process and unanticipated discovery of NBHSS UAD SW#2 compromised the site's contextual integrity. The shipwreck timbers comprising the site were all removed and will be discarded as contaminated hazardous materials. As in the case of NBHSS UAD SW#1, the recovery and documentation of NBHSS UAD SW#2's hull remains was considered by the MHC to constitute a mitigative measure for reducing the adverse impacts to the unanticipated shipwreck discovery site, and remediation activities were completed in the location of the unanticipated discovery. Consequently, ***no further investigation of the NBHSS UAD SW#2 discovery location is recommended. However, similar care and the established unanticipated discovery protocols should continue to be followed during all future phases of the NBHSS remediation project, because of the potential for additional submerged cultural resources (e.g., shipwrecks) to be encountered. The significant limitations of available geophysical survey technologies utilized during the original 1999 identification survey and even subsequent high-resolution resurveys within the NBHSS, combined with the large number of shipwrecks that were reported to have been sunk in New Bedford Harbor during the Revolutionary War, indicate that despite these identification survey efforts, the NBHSS still has a high archaeological sensitivity for containing additional, heretofore undetected shipwrecks within its Area of Potential Effect.***

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FIGURES

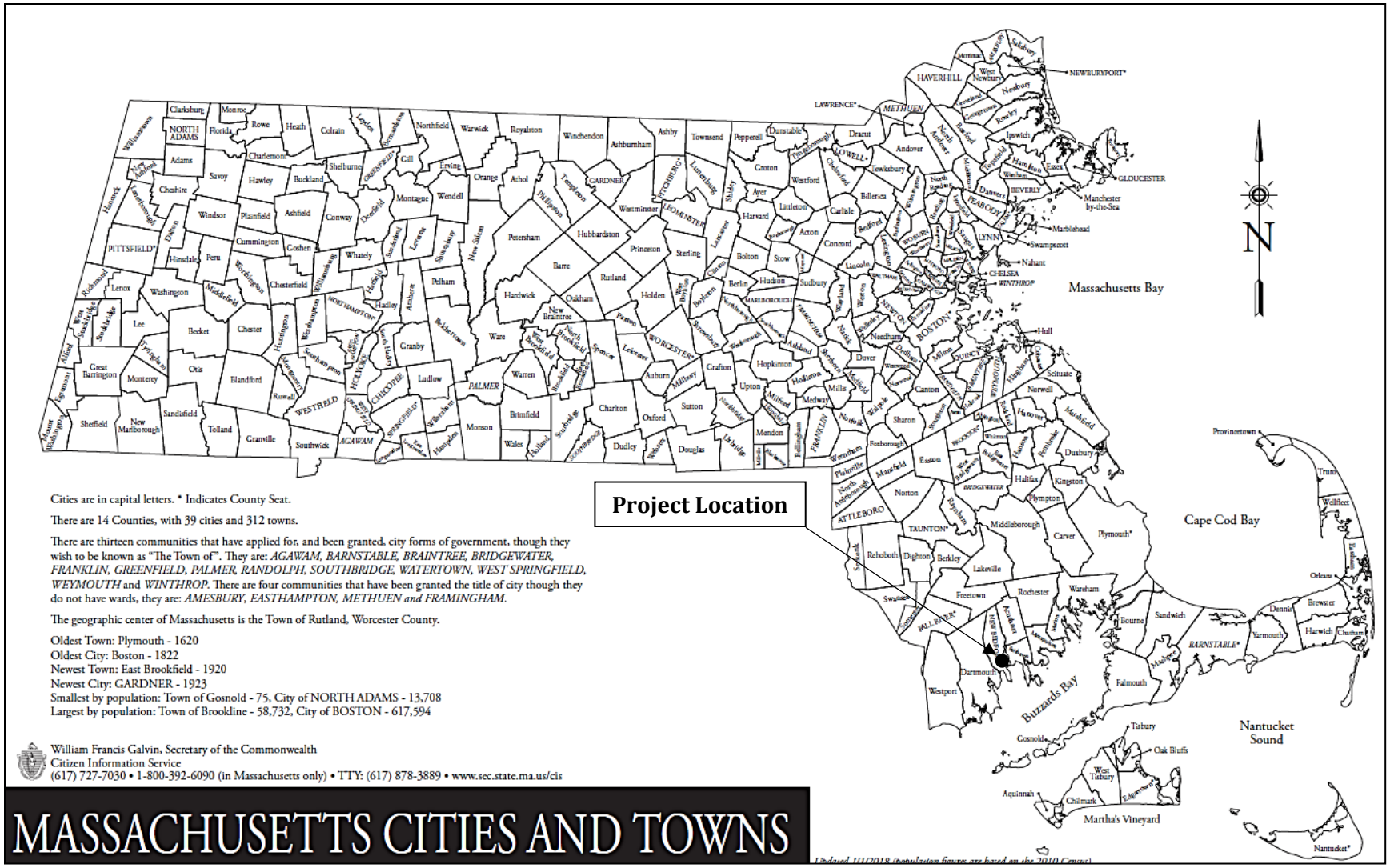

Figure 1. Project location within the Commonwealth of Massachusetts.

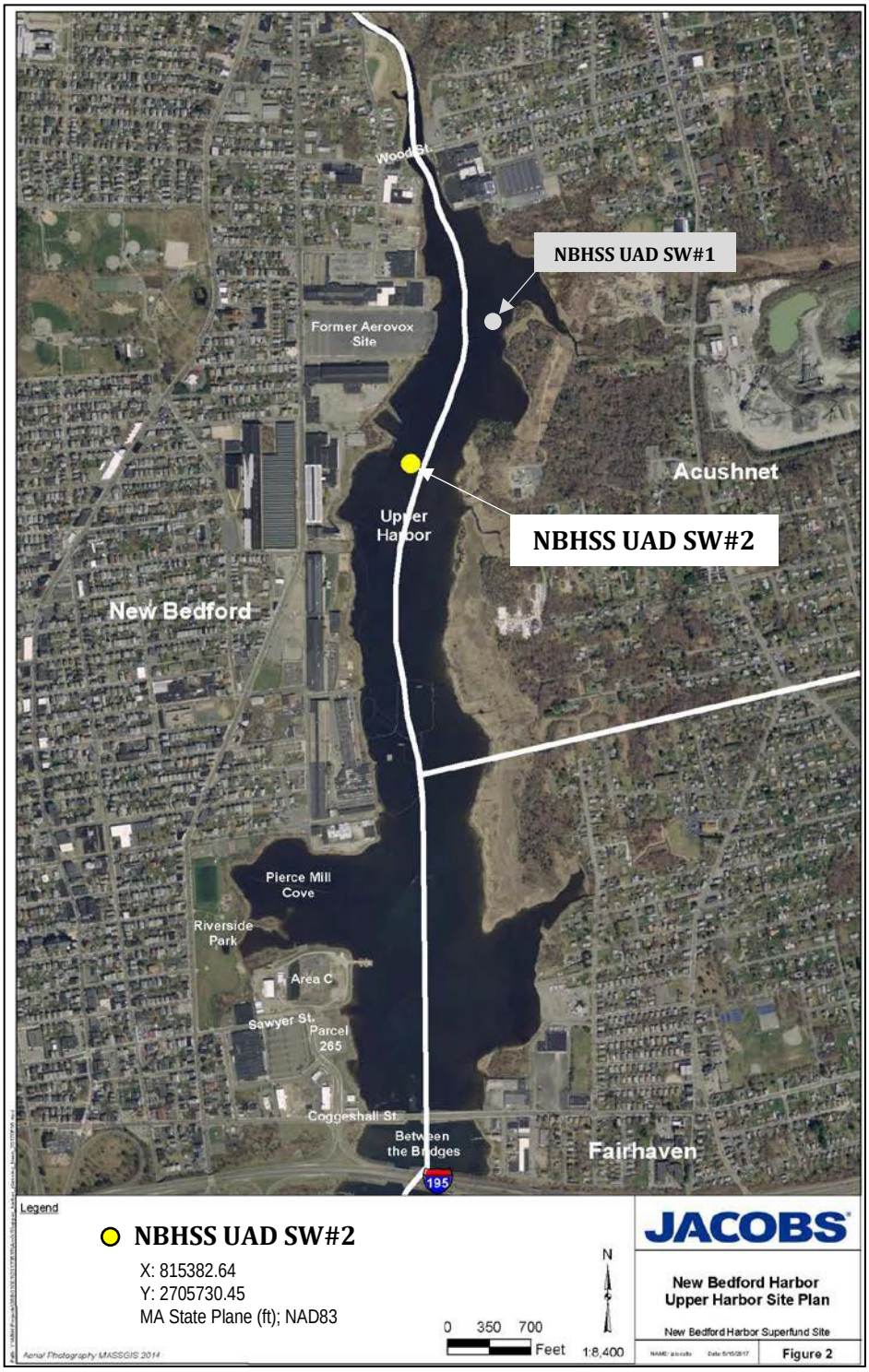

Figure 2. Plotted location of NBHSS UAD SW#2 in the Acushnet River portion of the NBHSS Upper Harbor area, within the boundaries of the City of New Bedford, Massachusetts (base-map source: Jacobs) (also note: location of NBHSS UAD SW#1).

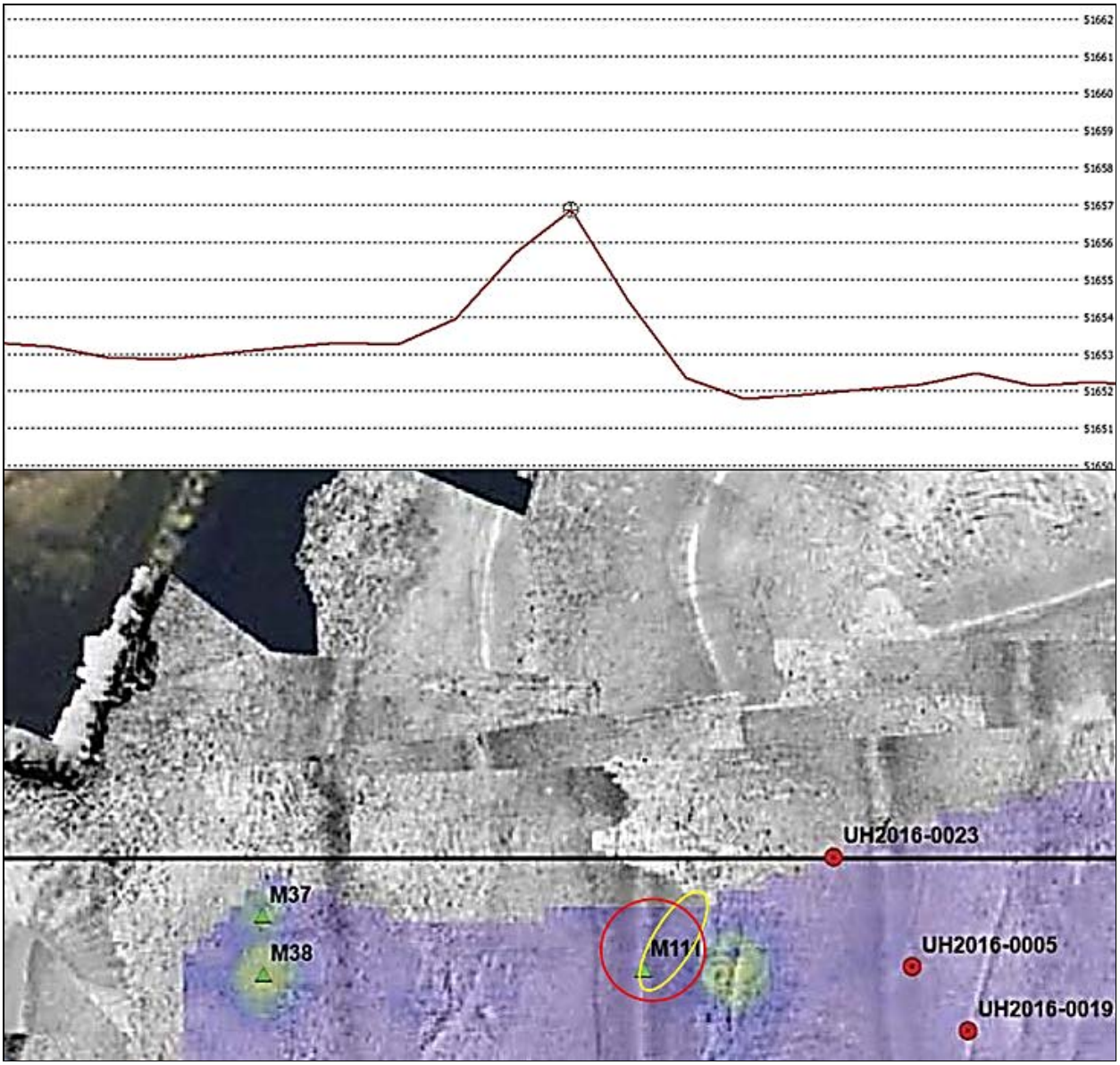

Figure 3. Raw magnetic data from the 2015 Task 2 (Submarine Cable Crossing) Area detailed re-survey showing (top image) the single isolated low-amplitude (4.5 gammas), short-duration (10 feet [3 meter]), monopolar magnetic anomaly (M111), and (bottom image) an excerpted plot of a sidescan sonar mosaic base-map with an overlying magnetic color-contour and point-plot of magnetic anomalies in the area of the NBHSS UAD SW#2 find (outlined in yellow). The combined sidescan sonar and magnetic data depicted in the lower image were recorded <u>prior</u> to NBHSS UAD SW#2's unanticipated discovery. The data shows no visible sidescan sonar contact at its location (source: base images for figure provided by CR).

Figure 4. The keel of NBHSS UAD SW#2 exposed at the surface at the time of its unanticipated discovery in July of 2016 during remediation activities within the 2015 Task 2 (Submarine Cable Crossing) Study Area of the NBHSS Upper Harbor area (photograph by Joshua Cummings, Jacobs).

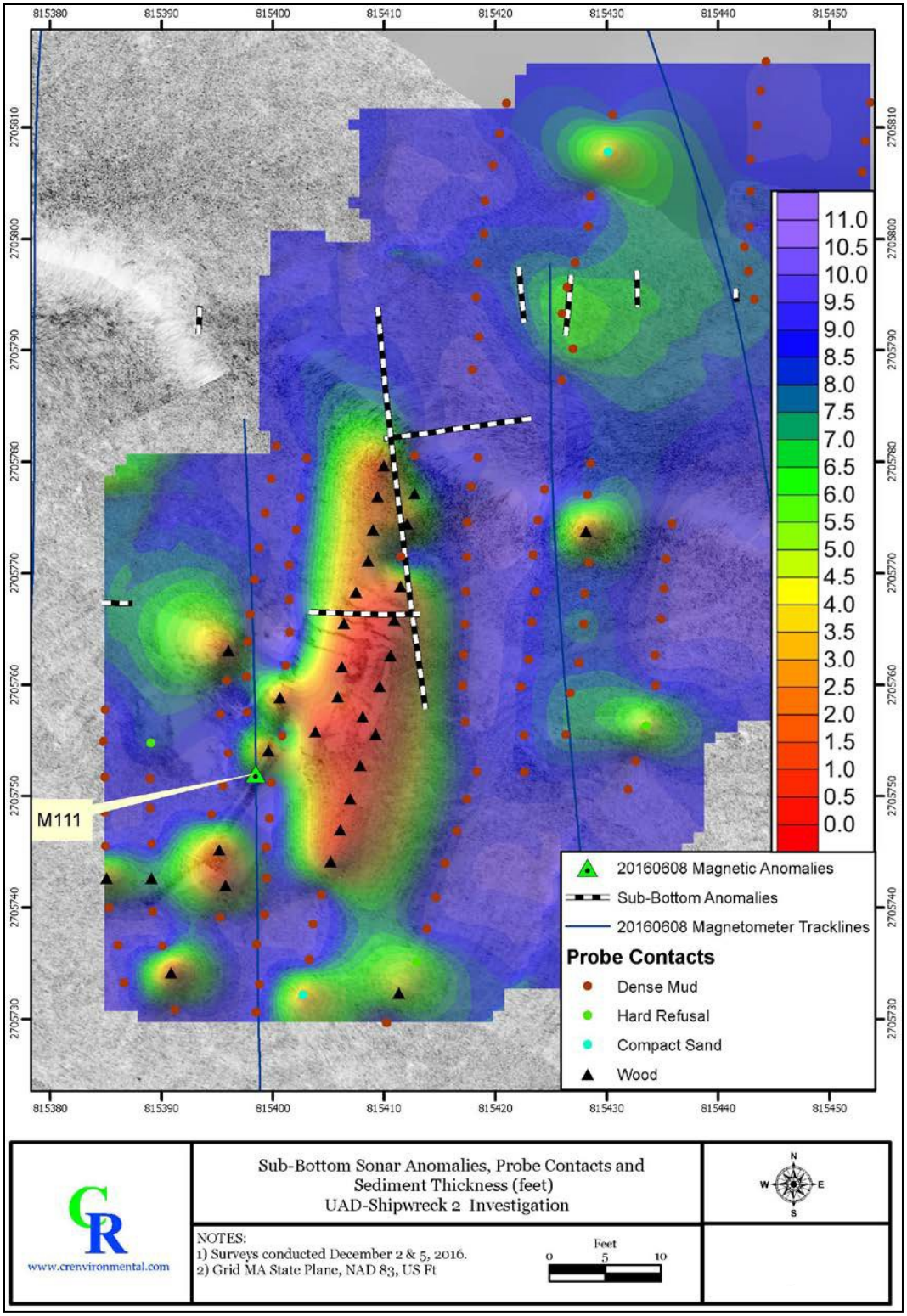

Figure 5. Plot showing results of CR's 2016 tile-probing survey superimposed onto the color-contoured sediment thicknesses over the buried portions of the NBHSS UAD SW#2 find site (source: CR).

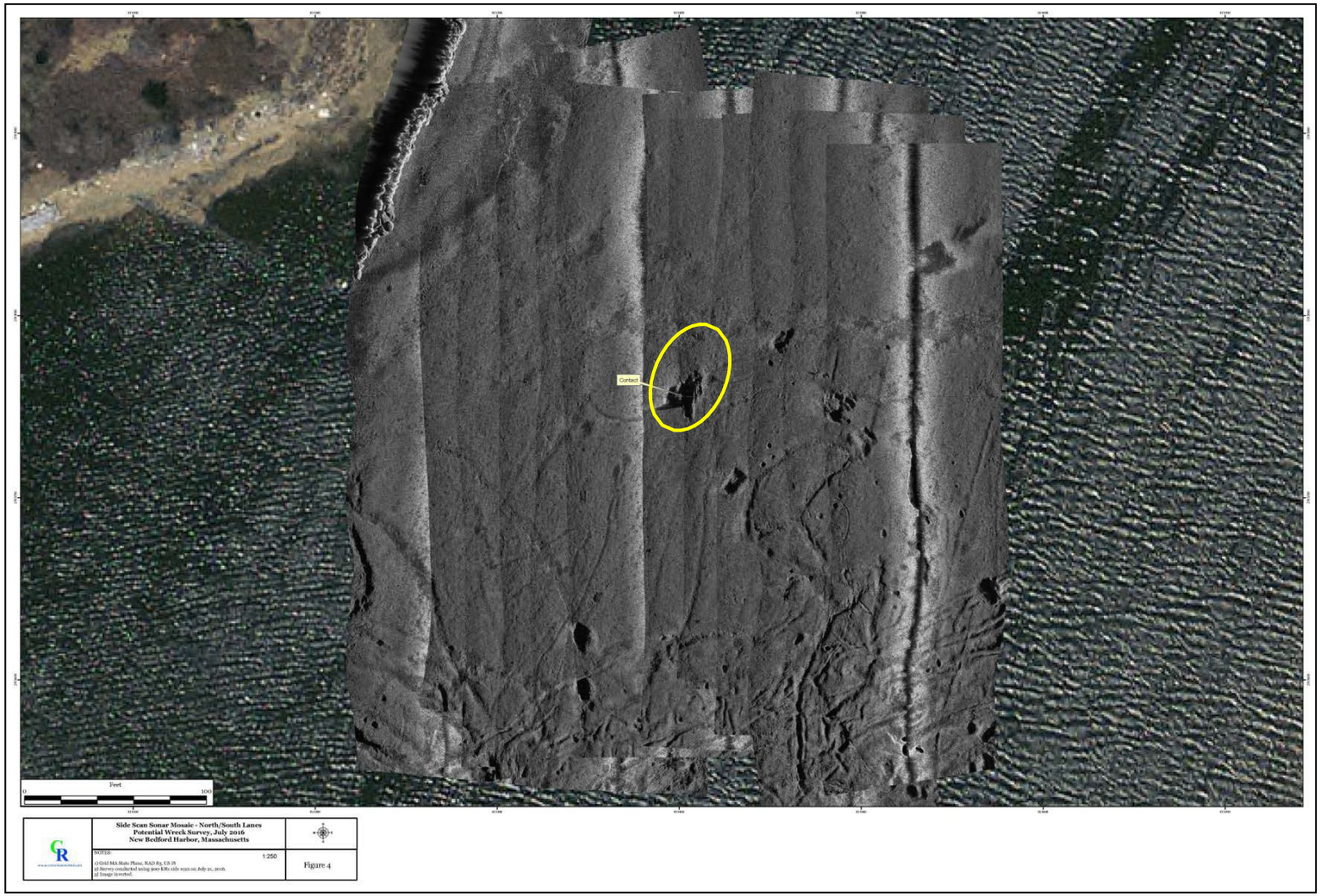

Figure 6. Sidescan sonar mosaic from CR's 2016 post-discovery detailed survey of the NBHSS UAD SW#2 find site. The labeled sonar 'contact' represents the ship remains exposed by debris removal remediation activities at the time of its discovery. The yellow oval is the approximate limit of the archaeological deposit – note that its buried northern half detected through sub-surface probing (see Figure 5) is invisible in the sonar record (base figure source: CR).

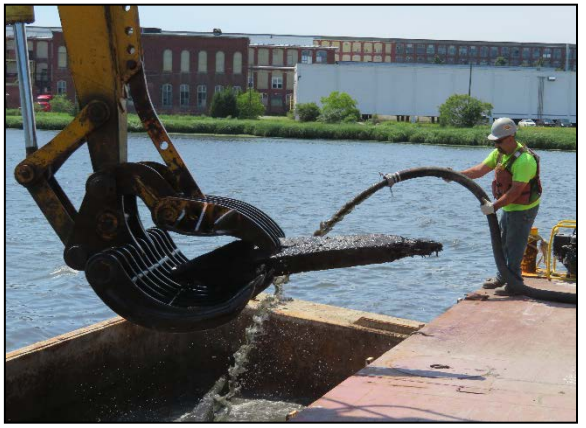

Figure 7. Spud-barge with machine (left image), and hopper-barges that were used for discarded debris and splintered/fragmented hull remains (upper right image), and hull remains that were kept wet and retained for documentation (lower right image) during the systematic marine archaeological recovery of NBHSS UAD SW#2 completed in July of 2017 (photographs by David S. Robinson, DSRA).

Figure 8. Cobbles/small boulders thought to possibly be ballast stones were recovered and set aside for documentation (upper figure), while NBHSS UAD SW#2's recovered hull timbers were double-wrapped to create polyethylene-sheet "timber packets" that kept them from drying-out prior to their transferal to shore for documentation (lower figure) (photographs by David S. Robinson, DSRA).

Figure 9. Double-wrapped timber packets containing NBHSS UAD SW#2's recovered hull remains were transferred to the NBHSS Sawyer Street facility's "pad" for temporary storage and archaeological documentation (photograph by David S. Robinson, DSRA).

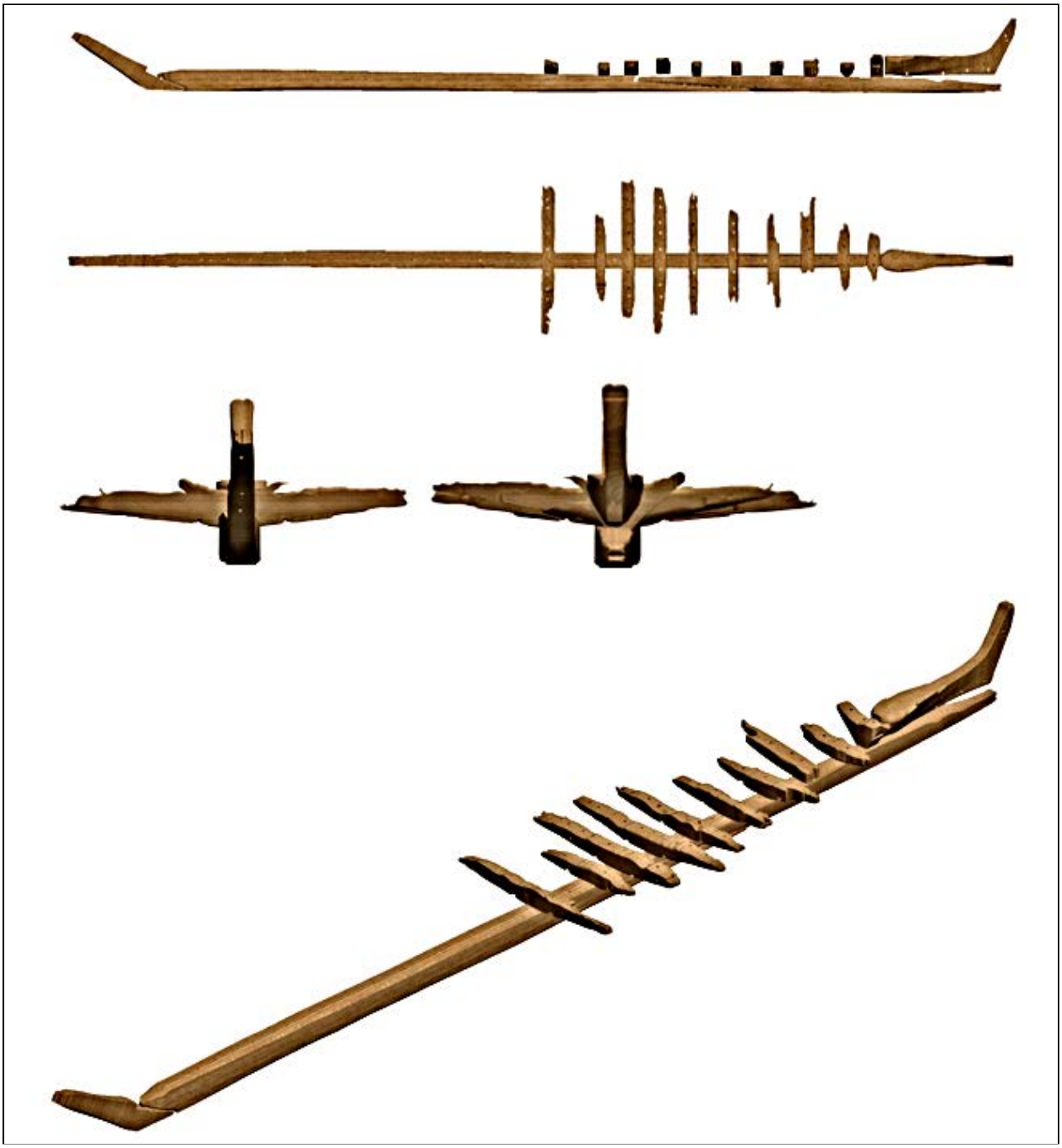

Figure 10. Multi-view 2D scale drawings of NBHSS UAD SW#2's principal recovered hull remains produced as part of DSRA's hull documentation task were selected, scanned, digitized, and imported into Solidworks' eDrawings Premium 2015 computer design and drafting program to develop 3D digital renderings of the individual timbers. These 3D digital timber renderings were then analyzed and used to digitally reconstruct NBHSS UAD SW#2's hull remains and create multiple views of them (images by David S. Robinson and Jake Piskura, DSRA).

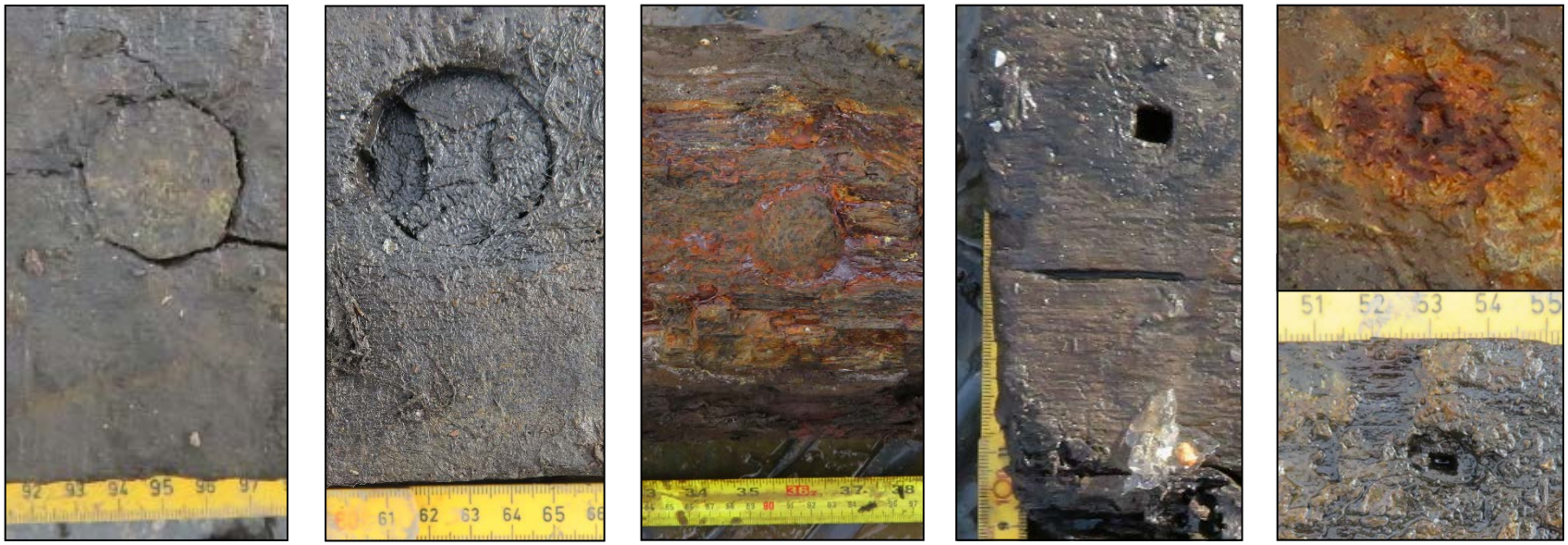

Figure11. Documented fasteners used in the construction of NBHSS UAD SW#2's hull included (from left-to-right) treenails, wedged treenails, iron bolts with peened heads (and washers), iron spikes, and iron (upper-right corner image) and wood (lower-right corner image) sheathing nails (photographs by David S. Robinson, DSRA).

Figure 12. In addition to iron sheathing nails, wooden sheathing nails (circled above) were also used to fasten NBHSS UAD SW#2's sacrificial wooden hull sheathing on the exterior of its hull (photograph by David S. Robinson, DSRA).

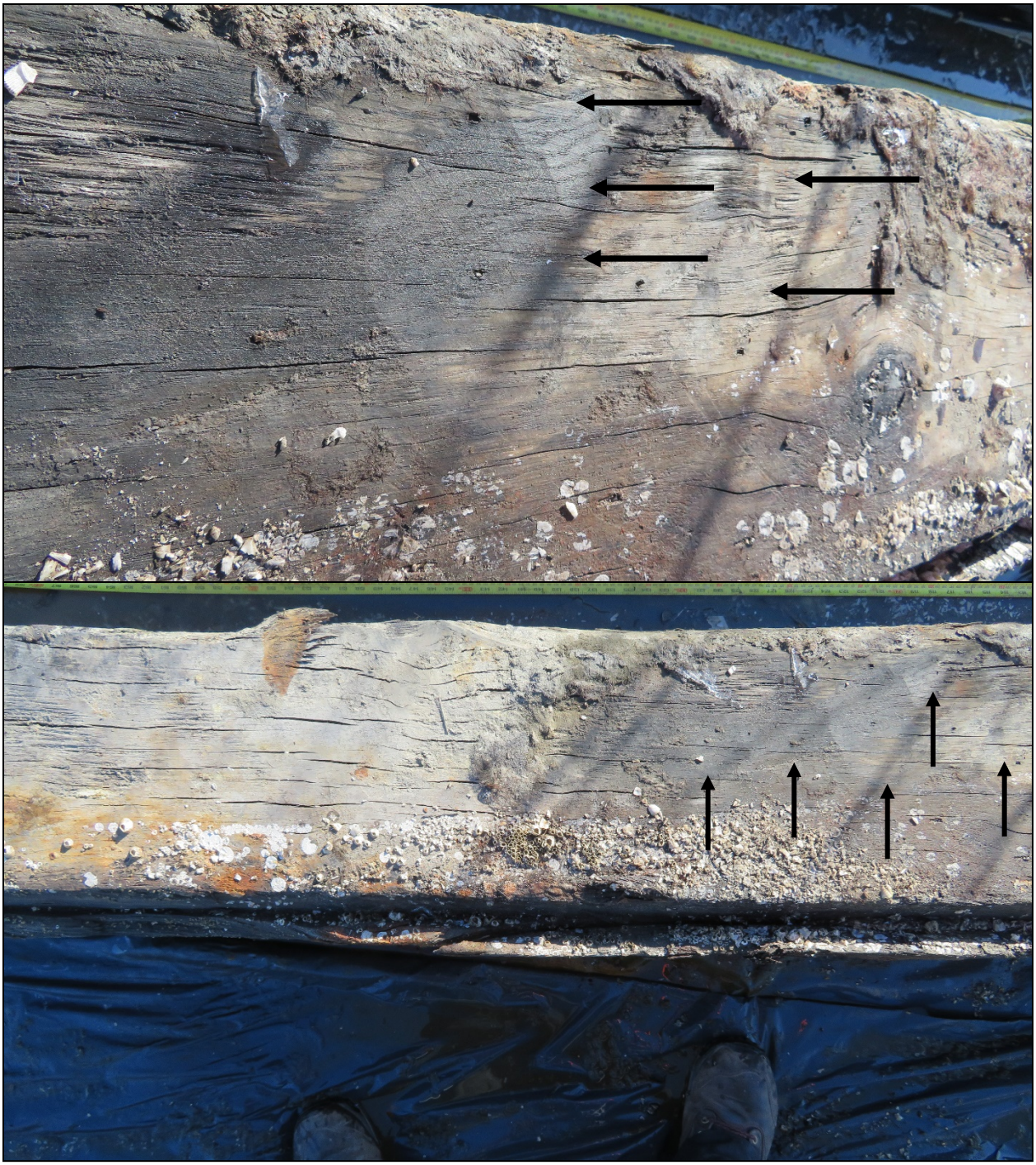

Figure 13. Shallow "scalloping" visible in the well-preserved surface of one of the sides of NBHSS UAD SW#2's keel (indicated by the arrows) resulting from the use of an adze to shape the large timber (photographs by David S. Robinson, DSRA).

Figure 14. A flat-nibbed scarf joint (left-side images) was used to connect NBHSS UAD SW#2's fore and aft keel sections. The joint was fitted with two stop-waters (right-side images) to prevent water from traveling along the seam into the hull (photographs by David S. Robinson, DSRA).

Figure 15. NBHSS UAD SW#2's inner stem (photograph by David S. Robinson, DSRA).

Figure 16. NBHSS UAD SW#2's stern knee (photographs by David S. Robinson, DSRA).

Figure 17. A total of 10 of NBHSS UAD SW#2's floors were among the recovered hull remains. This representative example exhibits charring (lower image) and damage from burning that was present on all of the recovered floors' upper surfaces and sides (photographs by David S. Robinson, DSRA).

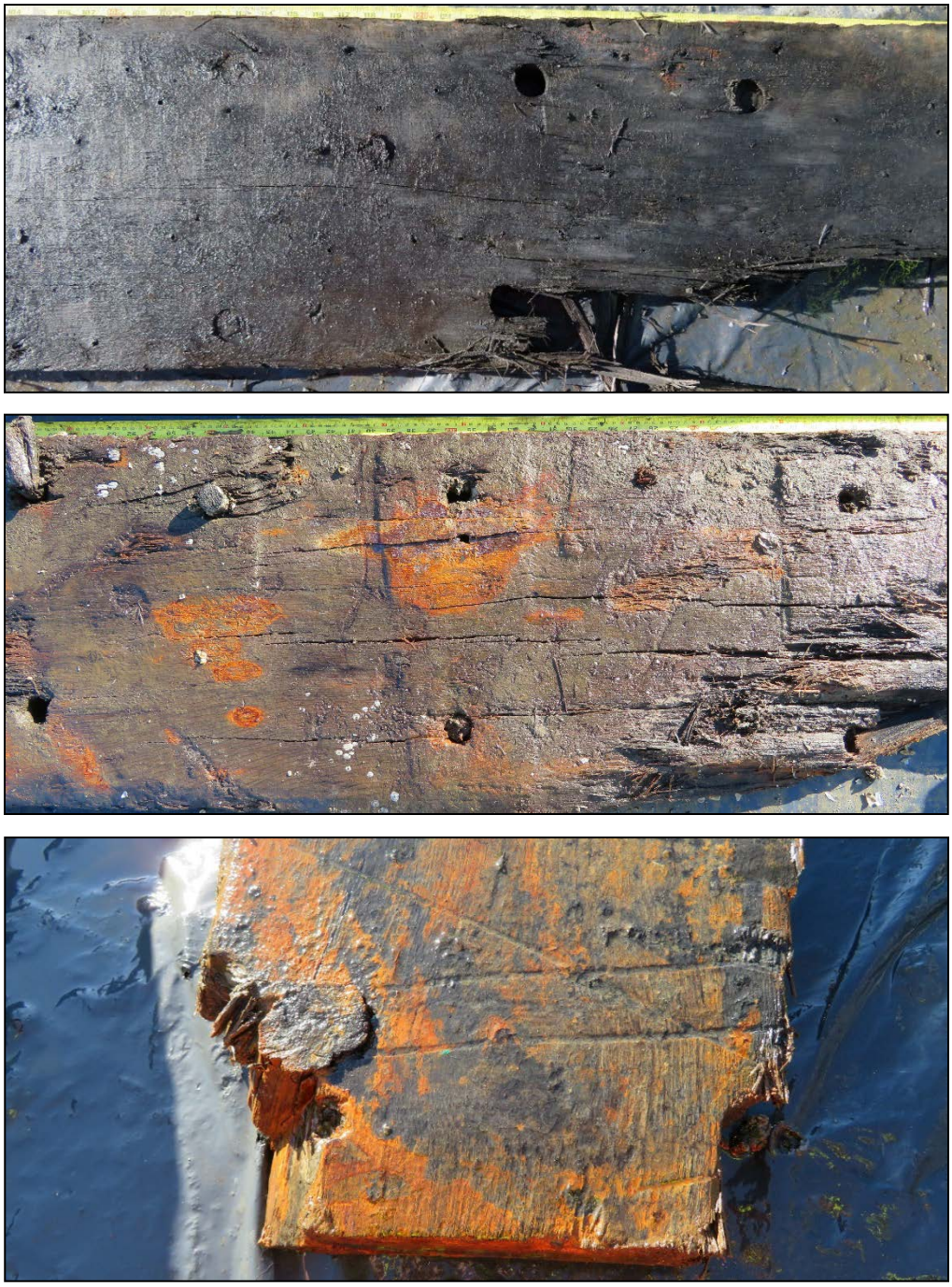

Figure 18. NBHSS UAD SW#2 hull planking (note: a. the excellent condition and saw marks in the planking's exterior [top image] formerly protected by tarred felt and wood sheathing; b. the preferential preservation of the planking's interior surface where it was in contact with floors and futtocks [middle image]; and c. the "XX" scribe mark at a frame location (indicated by the presence of treenails) (photos by David S. Robinson, DSRA).

Figure 19. Irregularly angled, widely-spaced, saw kerf marks were visible on both sides of the sheathing (top and bottom images), and were consistent with hand-cut "pit-" or "platform-" sawn lumber. Large areas of intact tarred felting were also still visible adhering to the inboard surfaces of the wood hull sheathing (photographs by David S. Robinson, DSRA).

TABLES

Table 1. NBHSS UAD SW#1 and NBHSS UAD SW#2 Scantlings						
	NBHSS UAD SW#1			NBHSS UAD SW#2		
TIMBER TYPE	Molded/Thickness	Sided/Width	Length	Molded/Thickness	Sided/Width	Length
KEEL	11.5-16 in (29.2-40.6 cm)	8.2-10 in (20.8-25.4 cm)	56.6 ft (17.3 m)	9.4-13.8 in (24-35 cm)	8.7-11 in (22-28 cm)	50.4 ft (2 sections) (15.4 m) (fully preserved)
KEEL SHOE	2.5 in (estimated) (6 cm)	n/a	n/a	4.3 in (11 cm)	8.9-11 in (22.6-28 cm)	36 ft (3 pcs. combined) (partially preserved) (11 m)
INNER STEM	1.7 ft (52 cm)	7-9 in (17.8-22.9 cm)	5.3 ft (1.6 m)	7.9-13.4 in (20-34 cm)	6.3-7.9 in (16-20 cm)	6.7 ft (2 m)
STERN KNEE	n/a	n/a	n/a	7-12.6 in (17.8-32 cm)	7-14.2 in (17.8-36 cm)	10.5 ft (horiz. arm) (3.2 m) 3.2 ft (vert. arm) (97.5 cm)
STERNPOST	10.6-14.8 in (27-38 cm)	8-9 in (20.3-23 cm)	6.2 ft (1.9 m)	n/a	n/a	n/a
FLOORS	9.4 in (24 cm)	6.7-10.2 in (17-26 cm) avg. spacing 22 in (on-center) (56 cm)	2.3-11 ft (0.7-3.4 m)	7.9-12.6 in (20-32 cm)	5.9-9.1 in (15-23 cm) avg. spacing 22.4 in (on-center) (57 cm)	2.6-7.9 ft (80 cm-2.4 m)
FUTTOCKS	8-9.5 in (20-24 cm)	5-9 in (12.7-22.9 cm)	3.8-5.6 ft (1.2-1.7 m)	4.7-6.3 in (12-16 cm)	6.3-7.9 in (16-20 cm)	2.6-3 ft (78-92 cm)
PLANKS	2 in (5 cm)	1.2-1.6 ft (36-49 cm)	7.2-19.7 ft (2.2-6 m)	2 in (5 cm)	1.4-1.5 ft (42-46 cm)	3.9-13.5 ft (partially preserved) (1.2-4.1 m)
SHEATHING	n/a	n/a	n/a	0.6 in (1.5 cm)	12.6-13 in (32-33 cm)	7.5-17.4 ft (2.3-5.3 m)
FASTENERS	Treenails (faceted/7-sided, 1.2 in [3 cm] in diameter); Iron Bolts (0.8 in [2 cm] round); Iron Spikes (0.4 in^2 [1cm^2]); Sheathing Nails (0.3 in^2 [0.8 cm^2])			Treenails (faceted/8-sided, 1.2 in [3 cm] in diameter); Iron Bolts 0.8 in [2 cm] round); Iron Spikes (0.4 in^2 [1 cm^2]); Sheathing Nails (iron/wood) (0.2 in^2 [0.4 cm^2]; 0.4 in^2 [1 cm^2] head)		

TABLE 2: SCANTLINGS OF NBHSS UAD SW#1 AND SW#2 AND OTHER ARCHAEOLOGICALLY DOCUMENTED COLONIAL MERCHANT VESSELS*

SHIPWRECK	NBHSS UAD SW#1	NBHSS UAD SW#2	Phips	Ronson	Rose Hill	Terence Bay	Reader's Point	Bermuda Collier	*Betsy*	Otter Creek	*Defence*	*Nancy*	Clydesdale Plantation
DATE	Late-1700s?	Mid- to Late-1700s?	Pre-1690	1700s-1740s	1725-1750?	Pre-1750s	Pre-1765	Pre-1770s	1772	1770s	1779	1789	1790s
NATIONALITY	Colonial – New England	Colonial – New England	Colonial – VA?	Colonial – Northern?	Colonial – MA	Colonial – New England	Colonial – Northern	British	British	Colonial	Colonial - MA	British Colonial	Southern
TONNAGE	est. 100-110 tons	est. 90-100 tons	45 tons	260 tons	103 tons	100-120 tons	100 tons	170-210 tons	180 tons	100 tons	170 tons	100-120 tons	20-25 tons
LENGTH OVERALL	est. 70 ft	est. 60 ft	–	100 ft	67 ft	70 ft	60 ft	–	–	58 ft	72 ft*	68 ft*	43 ft 9 in
LENGTH B/N PERP.	est. 57 ft	est. 51 ft	–	82 ft	–	–	–	Over 72 ft	73 ft 1.6 in	–	–	–	–
BEAM	est. 22 ft	est. 18 ft	–	27 ft	22 ft	–	18 ft	24 ft*	23 ft 7.35 in	16 ft	22 ft*	22 ft *	15 ft 5 in
LENGTH-TO-BEAM RATIO	est. 3.2:1	est. 3:1	–	3.7:1	3:1	–	3.3:1	> 3:1	> 3.2:1	–	> 3.3:1	3.1:1	2.8:1
DRAFT	–	–	–	11 ft	8 ft	–	–	–	9 ft 6 in	9 ft	–	–	–
HOLD DEPTH	–	–	–	7.5 ft	8.5 ft	–	–	11.5 ft	9 ft 10 in	6.5 ft	–	7 ft 6 in	6 ft 3 in
KEEL LENGTH	56.6 ft	50.4 ft	–	68 ft	54.5 ft	–	42 ft 5 in*	69 ft 6 in*	68 ft 2.5 in	49 ft 3 in*	–	59 ft 9 in	–
KEEL MOLDED	11.5-16 in (stern to bow)	9.4-13.8 in (stern to bow)	–	14 in	15 in	–	10.9 in	12 in	13.25 in	12 in	14 in	12-14.75 in	–
KEEL SIDED	8.2-10 in (stern to bow)	8.7-11 in (stern to bow)	–	12 in	8 in	–	9.6 in	16 in	14.4 in	9-12 in	8 in	8-9.5 in	–
KEEL WOOD TYPE	Hickory	–	–	–	Hard maple	–	Hard maple	Elm	White oak	White oak	Oak	Oak	Yellow pine
STEM LENGTH	broken approx. 5.3 ft above heel	inner stem - broken 6.7 ft above heel	–	–	–	–	–	–	–	–	–	–	–
STEM MOLDED	1.7 ft (at heel)	inner stem - 7.9-13.4 in	–	–	–	–	–	–	–	–	–	–	–
STEM SIDED	9-7 in (aft to fwd face)	inner stem - 7.9-6.3 in (aft face - heel to head)	–	–	–	–	–	–	–	–	–	–	–
STEM WOOD TYPE	White oak	–	–	–	–	–	–	–	–	–	–	–	–
STERNPOST LENGTH	6.2 ft	stern knee - 10.5 ft (horiz. arm); 3.2 ft (vert. arm)	–	–	–	–	–	–	–	–	–	–	–
STERNPOST MOLDED	10.6 in (uppermost preserved) to 14.8 in (at the heel)	stern knee - 7-12.6 in (heel to head)	–	–	–	–	–	–	–	–	–	–	–
STERNPOST SIDED	8 in (uppermost preserved) to 9 in (at the heel)	stern knee - 7-14.2 in (heel to head)	–	–	–	–	–	–	–	–	–	–	–
STERNPOST WOOD TYPE	White oak	–	–	–	–	–	–	–	–	–	–	–	–
KEELSON LENGTH	–	–	–	–	28 ft 9 in	–	–	–	56 ft 10.6 in	–	–	53 ft	–
KEELSON MOLDED	–	–	–	–	12 in	–	9.6 in	12.5 in	8.5-23 in	12 in	8 in	12 in	–
KEELSON SIDED	–	–	–	–	10 in	–	10.9 in	18 in	14.4 in	13.5 in	11.5 in	9 in	–
KEELSON WOOD TYPE	–	–	–	White oak	White oak	–	White oak	White oak	Pine and oak	White oak	Oak	Oak	Pine
FLOOR LENGTH (PRSVD. LGTH.)	2.3-11 ft	2.6-7.9 ft	–	–	–	–	–	–	–	–	–	–	–
FLOOR MOLDED (AVG.)	9.4 in (at the throat)	8.8 in (at the throat)	–	8.5 in	10.5 in	6 in	10 in	12-13 in	–	12-13 in	8-15 in	7.5-9 in	–
FLOOR SIDED (AVG.)	8.2 in (6.7-10.2 in)	8.6 in (5.9-9.1 in)	–	8.5 in	11 in	8 in	9.5 in	12 in	–	6-13 in	–	8-9 in	–
FUTTOCK MOLDED (AVG.)	3 sizes (9.5 in; 8 in; 8.5 in)	3 sizes (6.3 in; 5.7 in; 4.7 in)	4.7 in	8.5 in	10.5 in	–	8.5 in	4-10 in	7-9 in	12 in	8 in	8 in	–
FUTTOCK SIDED (AVG.)	3 sizes (9 in; 7 in; 5 in)	3 sizes (8 in; 7.1 in; 6.3 in)	6.3-10.2 in	8.5 in	11 in	–	8.9 in	10 in	9-10 in	–	8 in	8 in	–
FUTTOCK OFFSET FROM CL	–	–	–	0 in	11 in	–	12 in	6-8.5 in	10.75 in	13.5 in	–	7-10 in	–
SPACE B/N FRAMES (AVG.)	16 in (btwn floors over keel - floors spaced on 22 in centers); variable (2-8 in [btwn floors/futtocks])	14.5 in (btwn floors over keel - floors spaced on 20-22 in centers); variable (0-6 in [btwn floors/futtocks])	Various	6 in	0 in	2 in	0-4 in	1-4.5 in	1-5 in	3-27 in	5 in	5-9 in	–
FRAME WOOD TYPE	White oak	n/a	White oak	White or live oak	Beech and white oak	Oak	White oak	White oak	White oak	White oak	Oak	Oak, red cedar	Live oak
EXT. PLANKING THICKNESS	2 in	2 in	2 in	2 in	2.4 in	2 in	2 in	3 in	2.25-2.5 in	2 in	2-2.5 in	2 in	–
EXT. PLANKING WOOD TYPE	White oak	n/a	White oak	White oak	White oak	Oak	White oak	White oak	White oak	White oak	Oak	–	Pine
INT. PLANKING THICKNESS	–	–	1.6 in	2 in	2 in	2 in	2 in	3 in	2.5 in	2 in	–	1.5 in	–
INT. PLANKING WOOD TYPE	–	–	White Pine	White Oak	Red Oak	Oak	White oak, yellow pine	White oak	White oak	White oak	Oak	–	Pine
FASTENERS	Iron, treenails	Iron, treenails	Treenails	Iron, treenails	Iron, treenails	Iron, treenails	Iron, treenails	Iron, treenails	Iron, treenails	Iron, treenails	Iron, treenails	Mainly iron, some treenails	Mainly iron, few treenails
SHEATHING	wood?	softwood - 0.6 in	–	Thin wood	0.5 in hard pine	–	0.25 in pine, oak on keel	1 in scotch pine	1.25 in pine	0.9 in pine	–	–	–
NUMBER OF MASTS	Two?	One or Two?	One?	Three	One	Two?	One	Two?	Two	Two	Two	Two	One
ARMAMENT	–	–	–	(6) 6-pdrs	–	–	–	–	–	–	–	Unknown sizes	–
VESSEL TYPE/TRADE	West Indies/Intercolonial?	Regional Coastal Trader?	Coastal Trader	Tobacco/Trans-Oceanic	West Indies/Intercolonial?	Fishing	West Indies/Intercolonial	Collier/Transport	Collier/Transport	West Indies	Privateer	Lake trader	Coastal trader

* Source of data for "Other Archaeologically Documented Vessels": VanHorn (2004).

TABLE 3. VESSEL TYPES REGISTERED AT NEW BEDFORD (1785-1850)														
VESSEL TYPE	**YEAR**													**TOTAL**
	1785	**1790**	**1795**	**1800**	**1805**	**1810**	**1820**	**1825**	**1830**	**1835**	**1840**	**1845**	**1850**	
Bark	0	1	1	2	1	1	7	17	22	20	8	8	8	**96**
Brig	0	1	3	8	36	24	7	17	22	20	8	8	8	**162**
Brigantine	0	0	1	0	0	0	0	0	0	0	0	0	0	**1**
Schooner	1	6	11	11	24	12	33	14	18	30	16	5	11	**192**
Ship	3	3	8	19	65	77	55	65	51	52	17	19	10	**444**
Sloop	4	3	10	9	19	19	38	14	8	5	2	0	0	**131**
Snow	0	0	0	2	0	1	0	0	0	0	0	0	0	**3**
SUB-TOTAL	**8**	**14**	**34**	**51**	**145**	**134**	**140**	**127**	**121**	**127**	**51**	**40**	**37**	**1,029**

(data source: Works Progress Administration [1940])

APPENDICES

APPENDIX A

PROJECT CORRESPONDENCE

The Commonwealth of Massachusetts
William Francis Galvin, Secretary of the Commonwealth
Massachusetts Historical Commission

July 6, 2017

Karen Lumino
US Environmental Protection Agency, Region 1
5 Post Office Square
Mailcode OSRR07-4
Boston, MA 02109

RE: New Bedford Harbor Superfund Site, NBHSS Wooden Shipwreck #2 Work Plan, New Bedford, MA.
MHC #RC.17682.

Dear Ms. Lumino:

Staff of the Massachusetts Historical Commission (MHC), the office of the Massachusetts State Historic Preservation Officer, have reviewed your letter of June 7, 2017, and the *Draft Final Work Plan, Marine Archaeological Investigation: Removal and Documentation of the Unanticipated Discovery "NBHSS Wooden Shipwreck #2" in the 2015 Task 2 (Submarine Cable Crossing) Study Area, Acushnet River, New Bedford Massachusetts, May 18, 2017 (rev. 1, June 5, 2017)* that was prepared by DSRA, Inc., received by the MHC on June 9, 2017.

The MHC concurs with the EPA's proposed approach for addressing potential project-related adverse effects to the NBHSS Wooden Shipwreck #2. The MHC looks forward to reviewing DSRA's draft technical report of the archaeological monitoring and documentation that should be submitted to the MHC in bound, paper format by mail or delivery.

The MHC requests that the draft technical report include a brief consideration of the limitations of current marine survey methods and techniques for the identification of historical wooden vessels within gaseous bottom sediment conditions. Recommendations for improving identification techniques and methods during future marine surveys in similar settings should be proposed in the draft report.

To incorporate the results in the MHC's inventory systems, the MHC will require two bound, paper copies of the final archaeological report that addresses technical review comments on the draft report. The report needs to include an archaeological abstract prepared in accordance with the State Archaeologist's guidelines. The two copies of the final report needs to be submitted with: (1) a CD-ROM with a Word file listing the report author(s), date, report title, page count, and the archaeological abstract; and (2) a completed MHC historical archaeological site inventory form for the NBHSS Wooden Shipwreck #2, with a USGS locus map, and smaller scale plans, drawings, photographs, etc.

Thank you for your assistance and cooperation in facilitating this review. These comments are provided to assist in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800) and the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic*

Preservation (48 Fed. Reg. 190 (1983)). If you have questions or require additional information, please contact Jonathan K. Patton at this office.

Sincerely,

Brona Simon

Brona Simon
State Historic Preservation Officer
Executive Director
State Archaeologist
Massachusetts Historical Commission

xc: Marc Paiva, USACOE-NED
New Bedford Whaling National Historical Park, Attn: Jan da Silva
Victor T. Mastone, BUAR
New Bedford Whaling Museum
New Bedford Waterfront Historic Area League
Anne Louro, City of New Bedford
Acushnet Historical Commission
David S. Robinson, DSRA, Inc.

>> -----Original Message-----
>> From: Mastone, Victor (ENV) [mailto:victor.mastone@state.ma.us]
>> Sent: Thursday, June 29, 2017 11:08 AM
>> To: Paiva, Marcos A CIV USARMY CENAE (US) <Marcos.A.Paiva@usace.army.mil>
>> Subject: [Non-DoD Source] RE: New Bedford Shipwreck #2 - Upper Harbor Area
>>
>> Marc,
>>
>> The Board concurs with the work plan proposed by David S. Robinson & Associates, Inc., for the unanticipated discovery of wooden vessel remains.
>>
>> I have also attached a copy of the letter to David S. Robinson & Associates, Inc., renewing Special Use Permit No. 14-001. I thought you might find record as additional confirmation of BUAR's concurrence with the work plan.
>>
>> Please keep me in the loop as materials are being documented rather than wait until draft reports are available.
>>
>> Sorry for my delay. I have never been so busy as I have for the past few months.
>>
>> Vic

APPENDIX B

MBUAR SPECIAL USE PERMIT APPLICATION & PERMIT

The COMMONWEALTH OF MASSACHUSETTS
BOARD OF UNDERWATER ARCHAEOLOGICAL RESOURCES
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
251 Causeway Street, Suite 800, Boston, MA 02114-2136
Tel. (617) 626-1141 Fax (617) 626-1240 Web Site: www.mass.gov/orgs/board-of-underwater-archaeological-resources

30 March 2018

David S. Robinson, M.A., R.P.A.
David S. Robinson & Associates, Inc.
55 Cole Street
Jamestown, RI 02835

RE: Supplemental Marine Archaeological Reconnaissance Survey, New Bedford Harbor Superfund Site Remediation, Acushnet, Fairhaven, and New Bedford, MA
Renewal of Special Use Permit 14-001

Dear Mr. Robinson:

This letter confirms the vote taken by the Massachusetts Board of Underwater Archaeological Resources on 29 March 2018 to renew Special Use Permit No. 14-001 to David S. Robinson & Associates, Inc. (DSRA) for marine archaeological reconnaissance survey as part of the in New Bedford Harbor Superfund Site Remediation in Acushnet, Fairhaven, and New Bedford for the areas detailed on the figures accompanying the application. The duration of this permit is one year from the date of issuance with its expiration date as 29 March 2019.

This permit is herein granted dependent upon DSRA's compliance with the Board's Regulations (312 CMR 2.00). All work must be conducted in accordance with Board directives, standard conditions and the Scope of Services included in the application. Activities allowed under this permit include remote sensing, archaeological site examination and recovery to determine the presence or absence of potential submerged archaeological resources and undertake necessary recovery and documentation of these resources in the permit area. For projects subject to Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800), permittees are directed to consult with, provide their proposed research design and methodology to, and obtain the approval of the State Historic Preservation Office/Massachusetts Historical Commission and the lead federal agency in accordance with 36 CFR 800.4, prior to conducting the field investigation. This permit does not relieve the permittee or any other person of the necessity of complying with all other federal, state and local statutes, regulations, by-laws and ordinances.

If you should have any questions or need further assistance, do not hesitate to contact the Board at the address above or by telephone at (617) 626-1141.

Sincerely,

Victor T. Mastone
Director

/vtm

THE COMMONWEALTH OF MASSACHUSETTS
BOARD OF UNDERWATER ARCHAEOLOGICAL RESOURCES
251 Causeway Street, Suite 800, Boston, MA 02114

SPECIAL USE PERMIT APPLICATION

RENEWAL OF BUAR SUP PERMIT #14-001 FOR 2018-19

In accordance with 312 CMR 2, rules and regulations established by the Board of Underwater Archaeological Resources under MGL C. 91, s. 63, as amended, the undersigned herewith makes application for a permit to conduct archaeological research activities to identify and/or examine underwater archaeological resources located within the inland and coastal waters of the Commonwealth.

PLEASE TYPE OR PRINT LEGIBLY

NAME(S): David S. Robinson, MA RPA
ORGANIZATION: David S. Robinson & Associates, Inc.
(Applicant must be a qualified archaeologist or archaeological organization meeting the minimum qualifications under 312 CMR 2.09(4)(d); if multiple applicants, provide information for all parties and each must sign. If a corporation, include a copy of the certificate of incorporation with this application, and write both corporate name and contact information.)
ADDRESS: 55 Cole Street, Jamestown, RI 02835

TELEPHONE NUMBER: 401-578-7233 **FAX NUMBER:** n/a
EMAIL ADDRESS: davidandhayley1@cox.net

PROJECT NAME: New Bedford Harbor Superfund Site Remediation (2014)
LOCATION OF PROPOSED ACTIVITY
Nearest City or Town: New Bedford
Name of Water Body: New Bedford Harbor
Depth of Water: 0-23 ft
Total Acreage of the Project Area: N/A
Description of Proposed Permit Area (narrative):
New Bedford's Upper Harbor Area - EXPANDED S TO ENCOMPASS LOCATION OF NBHSS UAD SW#3, South of Rte I-195 Bridge in the Lower Harbor Area at: 814848.57, 2698955.62 (MA State Plane, NAD 83, US FT)

Longitude and Latitude of Proposed Project Area (Project area of potential effect):
NE (N limit of upper harbor) NW (N limit of upper harbor)
SE 41 39'05" W70 55'05" SW 41 39'05" W70 55'16"

Please attach a copy of the section of the NOAA nautical chart(s) or USGS topographic map(s).
(Clearly indicate the exact location of and the extent of the requested permit area on attached NOAA nautical chart or USGS topographic Map, specifying marker buoys, longitude and latitude, loran bearings and/or any other identifying features which define the requested Permit area. Use the space provided or attach additional sheets if necessary to complete this section.)

PROJECT PROPONENT (if not applicant)
CONTACT NAME/ORGANIZATION: Marc Paiva (USACE)
ADDRESS:
TELEPHONE NUMBER: 978-318-8796 **FAX NUMBER:**
EMAIL ADDRESS: marcos.a.paiva@usace.army.mil
PROJECT DESCRIPTION WHICH INCLUDES THE PURPOSE AND GOALS (attach additional sheets as needed):
(Already on file with MBUAR)

DESCRIPTION OF ANY KNOWN UNDERWATER ARCHAEOLOGICAL RESOURCE IN THE PROJECT AREA
No u/w arch. resources known in marine area. SW#2 and SW#3 removed.

Continued on page 2

Applicant initial DSR and date 2/26/18 to indicate concurrence with 312 CMR 2.

DSR 2/26/18

PLEASE INDICATE THE TYPE OF INVESTIGATION BEING UNDERTAKEN FOR THIS PROJECT (check one):

- [x] Reconnaissance Survey
- [ ] Intensive Survey
- [ ] Site Examination
- [ ] Data Recovery

PLEASE ATTACH A COPY OF YOUR RESEARCH DESIGN AND DESCRIBE IN AS MUCH DETAIL AS POSSIBLE WHAT YOU PLAN TO DO, INCLUDING DOCUMENTARY RESEARCH, REMOTE SENSING, ON-SITE ACTIVITIES, INCLUDING TESTING, EXCAVATION, RESOURCES RECOVERY, CONSERVATION AND CURATION, ETC. (attach additional sheets as needed): Providing on-call marine archaeological supplemental reconnaissance survey and unanticipated discovery response to the US EPA/USACE in support of their on-going remediation activities in the NBHSS's Upper Harbor and upper Lower Harbor Areas.

(This work plan should include, but not limited to, a description of: 1.) the plans to document activities and finds: 2. the inventory and catalogue which shall be maintained for all recovered artifacts; 3.) the artifact conservation program; and 4. the artifact repository)

WHAT IS YOUR PROPOSED WORK SCHEDULE (attach additional sheets as needed)?
Work provided on an on-call capacity. Currently doing data-analysis for NBHSS UAD SW#2 and just beginning documentation of timbers recovered from NBHSS UAD SW#3.

PROFESSIONAL QUALIFICATIONS OF APPLICANT: (1) ON A SEPARATE SHEET, PROVIDE A PERSONNEL OR ORGANIZATION CHART INDICATING THE NAMES, DUTIES AND RESPONSIBILITIES OF KEY PERSONNEL; (2) INCLUDE COPIES OF THE CURRICULA VITAE FOR THE PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR, PROJECT ARCHAEOLOGIST, AND OTHER KEY STAFF AS NECESSARY. (on file)

WHAT ARE YOUR PUBLIC BENEFIT PLANS, SUCH AS PUBLIC DISPLAYS, PUBLIC PRESENTATIONS, AND/OR PUBLICATION OF THE RESULTS OF YOUR WORK (Attach additional sheets as needed)? (on file)

YOU MAY INCLUDE ANY OTHER INFORMATION YOU BELIEVE MAY ASSIST THE BOARD IN ASSESSING YOUR APPLICATION (Attach additional sheets as needed) This is an administrative renewal of DSRA's BUAR SUP #14-001, for on-call supplemental survey and unanticipated discovery response on behalf of the EPA and USACE in support of their on-going remediation activities being undertaken in the NBHSS.

The undersigned understands and acknowledges that all underwater archaeological resources recovered under a special use permit remain the property of the Commonwealth of Massachusetts.

The undersigned understands and acknowledges that this permit does not authorize the excavation of human remains.

The undersigned understands and acknowledges that the Board may deny this permit application or revoke a permit granted whenever the Board determines that there is substantial fraud, deceit, corruption, or misrepresentation in the information or filing of this permit application.

I have read and agree to carry out the underwater archaeological investigations to the standards outlined in 312 CMR 2.

(Signature of Principal Investigator/Project Director)	(Signature of Project Archaeologist)	2/26/18 (Date)
David S. Robinson, MA, RPA (Type or Print Name)	same (Type or Print Name)	same (Date)

FOR OFFICIAL USE ONLY (DO NOT COMPLETE THIS SECTION)

Date and Time Received: By:

2017 ANNUAL REPORT BUAR

Special Use Permit No. 14-001
NBHSS Dredging Project, Acushnet and New Bedford, MA
(MHC #RC.17682)
David S. Robinson & Associates, Inc.,
Jamestown, RI

In 2017, under BUAR Special Use Permit #14-001, David S. Robinson & Associates, Inc. (DSRA) continued serving as the on-call marine archaeologist for CR Environmental, Inc. (CR) and Jacobs Engineering, Inc. (Jacobs), in support of the United States Environmental Protection Agency's (EPA) and the United States Army Corps of Engineers' (USACENAE) ongoing remediation activities within the New Bedford Harbor Superfund Site (NBHSS). The harbor portion of the NBHSS was surveyed and reported on previously by Dolan Research, Inc. (Dolan) between 1999 and 2001 with the BUAR and MHC concurring with the survey's results and recommendations. Since the unanticipated discovery and subsequent marine archaeological investigation of an historical wooden shipwreck (i.e., "NBHSS UAD SW#1") in the Dolan-surveyed Upper Harbor Area in 2009, DSRA's David Robinson has served in an on-call capacity and has, working with CR, completed supplemental surveys of several portions of the Upper Harbor Area. Late in 2016, another unanticipated discovery of historical wooden sailing vessel remains (NBHSS UAD SW#2) was made in a portion of the Upper Harbor Area of the NBHSS that had been resurveyed by DSRA and CR. This was followed in 2017 by more unanticipated discoveries of submerged vessel remains in the non-resurveyed Lower Harbor Area by Cashman Dredging, the EPA and USACE's Lower Harbor Area dredging contractor. These vessel remains consisted of historical wooden sailing vessel remains (NBHS UAD SW#3) and the remains of a modern, small screw-propelled vessel (NBHSS UAD SW#4). Work Plan protocols for addressing NBHSS UAD SW#2 and SW#3 were prepared by DSRA and submitted to EPA, USACE, MHC, and BUAR for review, comment, and approval. The boundaries of DSRA's BUAR SUP No. 14-001 were also expanded southward to encompass NBHSS UAD SW#3's location. NBHSS UAD SW#4 was examined by DSRA and assessed as being the remains of a small, modern vessel not warranting additional archaeological investigation. The find locations of NBHSS UAD SW#2 and SW#3 were re-surveyed to help guide the systematic archaeological removal of the ship's timbers as hazardous materials. NBHSS UAD SW#2's timbers were recovered during the summer of 2017. SW#3's timbers were recovered in early 2018. The recovered timbers were transferred to shore for documentation, and double-wrapped in plastic to keep them wet. Post-recovery surveys were conducted at both find locations to confirm no elements of the shipwrecks were left behind. Documentation of NBHSS UAD SW#2 was completed in early 2018. Documentation of NBHSS UAD SW#3 began in early 2018 and is ongoing. Analysis of the timber documentation field notes and preparation of the supplemental memorandum report on NBHSS UAD SW#3 is underway. Completion and submittal of the NBHSS UAD SW#2 report is anticipated for July or August of 2018 with completion and submittal of the NBHSS UAD SW#3 report expected before in late 2018.

The COMMONWEALTH OF MASSACHUSETTS
BOARD OF UNDERWATER ARCHAEOLOGICAL RESOURCES
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
251 Causeway Street, Suite 800, Boston, MA 02114-2136
Tel. (617) 626-1141 Fax (617) 626-1240 Web Site: www.mass.gov/eea/agencies/czm/buar/

30 May 2017

David S. Robinson, M.A., R.P.A.
David S. Robinson & Associates, Inc.
55 Cole Street
Jamestown, RI 02835

RE: Supplemental Marine Archaeological Reconnaissance Survey, New Bedford Harbor Superfund Site Remediation, Acushnet, Fairhaven, and New Bedford, MA
Renewal of Special Use Permit 14-001

Dear Mr. Robinson:

This letter confirms the vote taken by the Massachusetts Board of Underwater Archaeological Resources on 25 May 2017 to renew, retroactive 30 March 2017, Special Use Permit No. 14-001 to David S. Robinson & Associates, Inc. (DSRA) for marine archaeological reconnaissance survey as part of the in New Bedford Harbor Superfund Site Remediation in Acushnet, Fairhaven, and New Bedford for the areas detailed on the figures accompanying the application. The duration of this permit is one year from the date of issuance with its expiration date as 30 March 2018.

This permit is herein granted dependent upon DSRA's compliance with the Board's Regulations (312 CMR 2.00). All work must be conducted in accordance with Board directives, standard conditions and the Scope of Services included in the application. Activities allowed under this permit include remote sensing, archaeological site examination and recovery to determine the presence or absence of potential submerged archaeological resources and undertake necessary recovery and documentation of these resources in the permit area. For projects subject to Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800), permittees are directed to consult with, provide their proposed research design and methodology to, and obtain the approval of the State Historic Preservation Office/Massachusetts Historical Commission and the lead federal agency in accordance with 36 CFR 800.4, prior to conducting the field investigation. This permit does not relieve the permittee or any other person of the necessity of complying with all other federal, state and local statutes, regulations, by-laws and ordinances.

If you should have any questions or need further assistance, do not hesitate to contact the Board at the address above or by telephone at (617) 626-1141.

Sincerely,

Victor T. Mastone
Director

/vtm

THE COMMONWEALTH OF MASSACHUSETTS
BOARD OF UNDERWATER ARCHAEOLOGICAL RESOURCES
251 Causeway Street, Suite 800, Boston, MA 02114

SPECIAL USE PERMIT APPLICATION

RENEWAL OF BUAR SUP PERMIT #14-001 FOR 2017-18

In accordance with 312 CMR 2, rules and regulations established by the Board of Underwater Archaeological Resources under MGL C. 91, s. 63, as amended, the undersigned herewith makes application for a permit to conduct archaeological research activities to identify and/or examine underwater archaeological resources located within the inland and coastal waters of the Commonwealth.

PLEASE TYPE OR PRINT LEGIBLY

NAME(S): David S. Robinson, MA RPA
ORGANIZATION: David S. Robinson & Associates, Inc.
(Applicant must be a qualified archaeologist or archaeological organization meeting the minimum qualifications under 312 CMR 2.09(4)(d); if multiple applicants, provide information for all parties and each must sign. If a corporation, include a copy of the certificate of incorporation with this application, and write both corporate name and contact information.)
ADDRESS: 55 Cole Street, Jamestown, RI 02835
TELEPHONE NUMBER: 401-578-7233 **FAX NUMBER**: n/a
EMAIL ADDRESS: davidandhayley1@cox.net

PROJECT NAME: New Bedford Harbor Superfund Site Remediation (2014)
LOCATION OF PROPOSED ACTIVITY
Nearest City or Town: New Bedford
Name of Water Body: New Bedford Harbor
Depth of Water: 0-23 ft
Total Acreage of the Project Area: N/A
Longitude and Latitude of Proposed Project Area (Project area of potential effect):
NE _____ NW _____
SE _____ SW _____
Description of Proposed Permit Area (narrative): New Bedford's Upper Harbor Area

Please attach a copy of the section of the NOAA nautical chart(s) or USGS topographic map(s).
(Clearly indicate the exact location of and the extent of the requested permit area on attached NOAA nautical chart or USGS topographic Map, specifying marker buoys, longitude and latitude, loran bearings and/or any other identifying features which define the requested Permit area. Use the space provided or attach additional sheets if necessary to complete this section.)

PROJECT PROPONENT (if not applicant)
CONTACT NAME/ORGANIZATION: Marc Paiva (USACE)
ADDRESS:
TELEPHONE NUMBER: 978-318-8796 **FAX NUMBER**:
EMAIL ADDRESS: marcos.a.paiva@usace.army.mil
PROJECT DESCRIPTION WHICH INCLUDES THE PURPOSE AND GOALS (attach additional sheets as needed):
(already on file with the MA BUAR)

DESCRIPTION OF ANY KNOWN UNDERWATER ARCHAEOLOGICAL RESOURCE IN THE PROJECT AREA
EPA-USACE reported unanticipated discovery of wooden hull remains encountered during pre-dredge debris removal operations late in 2016.

Continued on page 2
Applicant initial DSR and date 4/25/17 to indicate concurrence with 312 CMR 2.

APPLICATION FOR SPECIAL USE PERMIT (continued)

PLEASE INDICATE THE TYPE OF INVESTIGATION BEING UNDERTAKEN FOR THIS PROJECT (check one):

- [X] Reconnaissance Survey
- [ ] Intensive Survey
- [ ] Site Examination
- [ ] Data Recovery

PLEASE ATTACH A COPY OF YOUR RESEARCH DESIGN AND DESCRIBE IN AS MUCH DETAIL AS POSSIBLE WHAT YOU PLAN TO DO, INCLUDING DOCUMENTARY RESEARCH, REMOTE SENSING, ON-SITE ACTIVITIES, INCLUDING TESTING, EXCAVATION, RESOURCES RECOVERY, CONSERVATION AND CURATION, ETC. (attach additional sheets as needed): Providing on-call marine archaeological supplemental reconnaissance survey and unanticipated discovery field response to the US EPA and USACE in support of their on-going remediation activities in the NBHSS Upper Harbor Area.

(This work plan should include, but not limited to, a description of: 1.) the plans to document activities and finds: 2. the inventory and catalogue which shall be maintained for all recovered artifacts; 3.) the artifact conservation program; and 4. the artifact repository)

WHAT IS YOUR PROPOSED WORK SCHEDULE (attach additional sheets as needed)?
Work provided in an on-call capacity. No work presently scheduled; however, the unanticipated discovery of wooden vessel remains in late 2016 will require work in 2017. Preparation of an addendum to this permit renewal is planned.

PROFESSIONAL QUALIFICATIONS OF APPLICANT: (1) ON A SEPARATE SHEET, PROVIDE A PERSONNEL OR ORGANIZATION CHART INDICATING THE NAMES, DUTIES AND RESPONSIBILITIES OF KEY PERSONNEL; (2) INCLUDE COPIES OF THE CURRICULA VITAE FOR THE PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR, PROJECT ARCHAEOLOGIST, AND OTHER KEY STAFF AS NECESSARY.
(already on file with the BUAR)

WHAT ARE YOUR PUBLIC BENEFIT PLANS, SUCH AS PUBLIC DISPLAYS, PUBLIC PRESENTATIONS, AND/OR PUBLICATION OF THE RESULTS OF YOUR WORK (Attach additional sheets as needed)?
Supplemental technical memorandum reports presenting methods, results, and management recommendations are prepared for each phase of work.

YOU MAY INCLUDE ANY OTHER INFORMATION YOU BELIEVE MAY ASSIST THE BOARD IN ASSESSING YOUR APPLICATION (Attach additional sheets as needed)
This is an administrative renewal of DSRA's BUAR SUP #14-001, for on-call supplemental survey and unanticipated discovery response services being provided to the US EPA and USACE in support of the on-going remediation activities being undertaken in the NBHSS Upper Harbor.

The undersigned understands and acknowledges that all underwater archaeological resources recovered under a special use permit remain the property of the Commonwealth of Massachusetts.

The undersigned understands and acknowledges that this permit does not authorize the excavation of human remains.

The undersigned understands and acknowledges that the Board may deny this permit application or revoke a permit granted whenever the Board determines that there is substantial fraud, deceit, corruption, or misrepresentation in the information or filing of this permit application.

I have read and agree to carry out the underwater archaeological investigations to the standards outlined in 312 CMR 2.

(Signature of Principal Investigator/Project Director)	(same) (Signature of Project Archaeologist)	4/25/17 (Date)
David S. Robinson, MA, RPA (Type or Print Name)	(same) (Type or Print Name)	4/25/17 (Date)

FOR OFFICIAL USE ONLY (DO NOT COMPLETE THIS SECTION)

Date and Time Received: By:

2016 ANNUAL REPORT BUAR

Special Use Permit No. 14-001

NBHSS Dredging Project, Acushnet and New Bedford, MA (MHC #RC.17682)

David S. Robinson & Associates, Inc.,
Jamestown, RI

In 2016, under BUAR Special Use Permit #14-001, David S. Robinson & Associates, Inc. (DSRA) served as the on-call marine archaeologist for CR Environmental, Inc. (CR) and Jacobs Engineering, Inc. (Jacobs) in support of the United States Environmental Protection Agency's (EPA) and the United States Army Corps of Engineers' (USACE-NAE) ongoing remediation activities within the Upper Harbor portion of the New Bedford Harbor Superfund Site (NBHSS). The Upper Harbor portion of the NBHSS was surveyed and reported on previously by Dolan Research, Inc. (Dolan) between 1999 and 2001 with the BUAR and MHC concurring with the survey's results and recommendations. Since the unanticipated discovery of an historical wooden shipwreck in the surveyed Upper Harbor area in 2009, DSRA and others have served in an on-call capacity and have completed supplemental surveys of several portions of the Upper Harbor area. Late in 2016, another unanticipated discovery of wooden vessel remains was made. The area of the discovery was subjected to additional engineering survey by CR to delimit its extent and inform the preparation of a marine archaeological research design for removing and documenting the unanticipated discovery during the summer of 2017. This research design will be submitted to MBUAR as part of an addendum to Special Use Permit #14-001, as well as to the Massachusetts Historical Commission (MHC), and the Tribes.

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31 March 2016

David S. Robinson, M.A., R.P.A.
David S. Robinson & Associates, Inc.
55 Cole Street
Jamestown, RI 02835

RE: Supplemental Marine Archaeological Reconnaissance Survey, New Bedford Harbor Superfund Site Remediation, Acushnet, Fairhaven, and New Bedford, MA
Renewal of Special Use Permit 14-001

Dear Mr. Robinson:

This letter confirms the vote taken by the Massachusetts Board of Underwater Archaeological Resources on 31 March 2016 to renew Special Use Permit No. 14-001 to David S. Robinson & Associates, Inc. (DSRA) for marine archaeological reconnaissance survey as part of the in New Bedford Harbor Superfund Site Remediation in Acushnet, Fairhaven, and New Bedford for the areas detailed on the figures accompanying the application. The duration of this permit is one year from the date of issuance with its expiration date as 31 March 2017.

This permit is herein granted dependent upon DSRA's compliance with the Board's Regulations (312 CMR 2.00). All work must be conducted in accordance with Board directives, standard conditions and the Scope of Services included in the application. Activities allowed under this permit include remote sensing, archaeological site examination and recovery to determine the presence or absence of potential submerged archaeological resources and undertake necessary recovery and documentation of these resources in the permit area. For projects subject to Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR 800), permittees are directed to consult with, provide their proposed research design and methodology to, and obtain the approval of the State Historic Preservation Office/Massachusetts Historical Commission and the lead federal agency in accordance with 36 CFR 800.4, prior to conducting the field investigation. This permit does not relieve the permittee or any other person of the necessity of complying with all other federal, state and local statutes, regulations, by-laws and ordinances.

If you should have any questions or need further assistance, do not hesitate to contact the Board at the address above or by telephone at (617) 626-1141.

Sincerely,

Victor T. Mastone
Director

Cc: Brona Simon, MHC
Elaine Stanley, USEPA (via email attachment)
Marc Paiva, USACE (via email attachment)
Bettina Washington, WTGH/A (via email attachment)
Ramona Peters, MWT (via email attachment)

APPENDIX C

PROJECT SCOPE OF WORK AND WORK PLAN

Subcontractor: CR Environmental Inc. and David S. Robinson & Associates, Inc.

Work to be Performed: Development of Work Plan for Removal of Wooden Shipwreck, Archaeological Monitoring of Wreckage Recovery, Documentation of Wreckage for Phase II Marine Archaeological Site Exam-Level Investigation

1.0 Summary

1.1 Objective

The objective of this Statement of Work is to define the various tasks required to result in the removal, documentation, and a Phase II marine archaeological site exam-level investigation of what are the submerged remains of a wooden vessel identified within the upper portion of New Bedford Harbor. This work is to comply with relevant portions of Section 106 of the National Historic Preservation Act (NHPA) and will be conducted in consultation with the Massachusetts Historical Commission (MHC), under a permit issued by the Massachusetts Bureau of Underwater Resources (MBUAR). This effort is being performed in support of the ongoing remedial actions by Jacobs Engineering (Jacobs) at the New Bedford Harbor Superfund Site (Site).

1.2 Overview

Section 106 of the NHPA requires that all federal agencies take into account, prior to initiating or authorizing an undertaking the effects of that undertaking on historic places listed or eligible for listing in the National Register of Historic Places (NRHP). This includes submerged places, such as historic shipwrecks.

Prior to the initiation of field work at the Site, two intensive marine archaeological identification surveys were conducted utilizing the most modern means of remote sensing available at the time (2000 and 2016), including side scan sonar, magnetometer and sub-bottom profiler. Despite these surveys, wooden vessel remains were located during the execution of debris removal activities. This unanticipated discovery of the shipwreck occurred, because the wooden hull remains were undetectable to the standard suite of marine remote sensing survey instrumentation that was employed during the surveys. The shipwreck was buried beneath the harbor floor, so it presented no relief detectable with the sidescan sonar. The silts that it is buried in are highly-organic and gaseous silts, which made them impenetrable to the sub-bottom profiler. And any ferrous iron hull components (i.e., fasteners or hardware) that were once present on board the vessel have degraded to the point where they contain little or no ferrous mass and were, therefore, undetectable by the marine magnetometer.

A preliminary, post-unanticipated discovery detailed marine archaeology remote sensing survey was completed in 2016 to obtain additional data to provide Jacobs with a better sense of the overall extent of the shipwreck site and to enable the refinement of the avoidance buffer-zone established around it, and to inform the development of a plan for the systematic recovery of the ship remains for NRHP eligibility evaluation. This detailed marine archaeological remote sensing survey included intensive sidescan sonar survey of the area to document hull remains exposed above the harbor floor following their disturbance during discovery, additional attempts at sub-bottom profiler data acquisition (more likely to be effective after the disturbance and release of gases in the sediments) and systematic sub-surface physical probing with a steel tile-probe. This additional sidescan sonar surveying, probing and sub-bottom surveying were performed to determine the approximate horizontal extent of and burial depth of the ship remains.

In order to complete the ongoing harbor sediment remediation activities at the Superfund Site, removal of the wreckage is required. The results of the 2016 detailed marine archaeology remote sensing survey, coupled with the need to remove the wreckage led to recommendations made by Jacobs's on-call Marine Archaeologist, David S. Robinson and Associates, Inc. (DSRA). Those recommendations are the basis for this Scope of Work and include:

- development of a detailed work plan for the systematic removal the wooden vessel remains from the sediments and their transport to shore,
- acquisition or revision of appropriate permits to conduct the removal work,
- oversight of removal of vessel remains and temporary storage for transport to shore,
- documentation of vessel remains,
- preparation of a Draft Technical Report for review and comment by USACE, Jacobs, EPA and MBUAR,
- preparation of a Final Technical Report.

Description of Services

The following work scope shall be conducted:

1.3 Development of Detailed Work Plan

The work plan should, at a minimum, include a description of the methods proposed to recover, clean, temporarily store and transport the discovered wooden vessel remains as they are removed from the harbor sediments and brought ashore for documentation. The plan should include a list of necessary equipment and consumables, excluding PPE, which will be supplied to the on-site DSRA marine archaeologist by Jacobs. Site workers and equipment will be made available with advance notice to assist in this work. It is anticipated that Jacobs's dredge sub-contractor Sevenson Environmental Services, Inc. will provide a Komatsu PC-220 with an Add-A-Stick extension and hydraulic rake attachment (or equivalent) and an operator, a 40' x 40' deck barge with spuds, a work boat and an operator, two 50-cubic yard scows for containment of recovered debris and shipwreck materials, and a gas-powered water pump and hose for gross decontamination. The work plan should include the number of laborers anticipated to be required to handle, clean and temporarily store the materials at the archaeologist's direction.

The proposal should include the number of hours anticipated to develop the plan, respond to comments if needed and issue a final plan. The proposal should additionally include an itemized list, including costs, of equipment or consumables (excluding PPE) to perform the work in the plan.

1.4 MHC Coordination and Acquisition or Modifications to MBUAR Permit

The proposal should include the cost and hours needed to participate in the US Environmental Protection Agency (EPA) and the US Army Corps of Engineers – New England District (USACE-NAE) coordination with the MHC and to secure the proper MBUAR permit required to perform the work described in this SOW. If additional permits not identified in this SOW are necessary the type of permit, issuing agency and costs should be included in the proposal.

1.5 Monitoring of the Recovery of Wooden Vessel Remains

The proposal should detail the anticipated number of hours required to monitor the recovery of the wooden vessel remains, and their transport to shore and a temporary storage area at the Jacobs Sawyer St. facility, an hourly rate should be included in the proposal for the event the recovery duration is longer than anticipated.

1.6 Documentation of Wooden Vessel Remains

The proposal should include the number of hours anticipated to be required to properly document the recovered vessel's remains. An hourly rate should be included in the proposal in the event that the documentation duration is longer than anticipated. If additional offsite testing, such as laboratory work, is anticipated, descriptions of tests and costs should be provided.

Deliverables

1.7 Preparation of a Draft Technical Report

The proposal should include the hours required for the research and writing of a Draft Technical Report on the recovered wooden vessel remains. The author should anticipate receiving comments on the report, responding to the comments and resolution of comments in preparation for a final report. It is anticipated this report will be similar in scope to the technical shipwreck documentation report that was prepared by Fathom Research, LLC. and CR following the unanticipated discovery of historic wooden vessel remains in 2009.

1.8 Preparation of a Final Technical Report

The proposal should include the hours required to prepare and submit a Final Technical Report. It is anticipated this report will be similar in scope to the technical report prepared by Fathom Research, LLC. and CR following the unanticipated discovery of historic wooden vessel remains in 2009.

1.9 Development of Task Schedule

CR and DSRA are requested to assist Jacobs in formulating a schedule to complete the tasks described in this SOW. The schedule will have anticipated dates for the completion of key project milestones, such as the submission of the work plan, acquisition of required permits, removal of wreckage, documentation of wreckage, and delivery of the draft and final technical reports.

2.0 Subcontractor Requirements

2.1 Health and Safety

2.1.1 Site Specific Requirements

- Provide written Health and Safety Plan or provide statement that the Jacobs Project Health and Safety Plan will be adopted.
- Provide documentation for hazardous waste operations for all personnel actively participating in field activities. Documents include proof of 40-hours HAZWOPER training, requisite 8-hour refresher, and physician certification for the ability to work on a hazardous waste site.
- Provide at least one person on the field crew with current first aid and CPR training.
- Comply with Jacobs PPE requirements, including wearing a PFD for all work within 5' of the water's edge or on any floating plant.
- Assist the Jacobs Site Safety and Health Officer in complying with foul weather preparedness procedures.

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2.1.2 Jacobs Health and Safety Requirements

- Adhere to Jacobs Engineering Health and Safety Environmental Requirements for U.S. Subcontractors.

2.2 Security

- All personnel are required to sign in using the Daily Sign In book located at the reception desk in the Jacobs trailer at the front of the site. At the end of the day, sign out is also required.
- All personnel are to check in with Jacobs personnel as notification of presence on site and to receive an update to any specific requirements for work to be performed.
- Unsecured outside storage of equipment is available, if secure or indoor storage is required advance notice is necessary.

2.3 Work Requirements

- Attend and participate in Preparatory meeting with Jacobs and USACE staff prior to field operations.
- For site visits workers are required to furnish and properly wear PPE, at a minimum to include safety vest, hard hat, steel toe boots, shirt with sleeves and long pants.

3.0 Jacobs Requirements

In support of the CR/DSRA's responsibilities, Jacobs will be responsible for the following:

- Deploy personnel, as necessary, to direct field activities.

INTEGRITY • KNOWLEDGE • EXPERIENCE

DAVID S. ROBINSON & ASSOCIATES, INC.

Marine Archaeological Consultants

Draft Work Plan

Marine Archaeological Investigation: Removal and Documentation of the Unanticipated Discovery "NBHSS Wooden Shipwreck #2" in the 2015 Task 2 (Submarine Cable Crossing) Study Area

Acushnet River, New Bedford, Massachusetts

May 18, 2017

Submitted to:

CR Environmental, Inc.
639 Boxberry Hill Road
East Falmouth, Massachusetts 02536

INTRODUCTION

In response to a request from CR Environmental, Inc. (CR), David S. Robinson & Associates, Inc. (DSRA) is pleased to submit the following Draft Work Plan for performing a marine archaeological investigation of the submerged and buried remains of an historical wooden ship encountered as an unanticipated discovery on July 5, 2016 in the Acushnet River portion of the New Bedford Harbor Superfund Site (NBHSS) within the city of New Bedford, Bristol County, Massachusetts (Figure 1). The submerged vessel remains, termed here "NBHSS Shipwreck #2," were located by the Jacobs Engineering Group's (Jacobs) dredge sub-contractor, Sevenson Environmental Services, Inc. (Sevenson), during their Jacobs-supervised pre-dredge debris removal operations within the previously-surveyed and archaeologically-cleared 2015 Task 2 (Submarine Cable Crossing) Study Area of the NBHSS Upper Harbor. Pre-dredge debris removal operations are part of an ongoing federal program of environmental remediation activities being conducted within the NBHSS by the U.S. Environmental Protection Agency – Region 1 (EPA) and the U.S. Army Corps of Engineers (USACE-NAE). As the remediation activities constitute a federal undertaking requiring federal funds and permits, compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA) (36 CFR 800), is necessary. Section 106 of the NHPA requires federal agencies take into account the effects of their undertakings on cultural resources listed or eligible for listing in the National Register of Historic Places (National Register) (36 CFR 60). The agency must also afford the Advisory Council on Historic Preservation (ACHP) the opportunity to comment on the undertaking. The Section 106 process is coordinated at the state level by the State Historic Preservation Office (SHPO), which in Massachusetts operates within the offices of the Massachusetts Historical

Commission (MHC), working in consultation with the Massachusetts Board of Underwater Archaeological Resources (MBUAR).

Jacobs is the engineering consultant contracted by the EPA to conduct remediation of contaminated soils and sediments within the marine and terrestrial portions of the NBHSS. DSRA serves as Jacobs's principal 'on-call' archaeologist for the NBHSS through DSRA's contract with CR Environmental, Inc. (CR), Jacobs's principal geophysical survey and mapping consultant for the remediation project. To assist the EPA in its compliance with Section 106 of the NHPA, John Milner Associates, Inc. (JMA) and its marine archaeological consultant, Dolan Research, Inc. (Dolan), as well as The Public Archaeology Laboratory, Inc. (PAL), conducted an initial archaeological sensitivity assessment and Phase I archaeological site identification surveys of the NBHSS's marine, intertidal and upland remediation areas between 1999 and 2003 (Chadwick and Klein 2003; Cox, Jr. 2000; Kellogg and Klein 2001a, 2001b; Robinson 2016; Robinson and Wright 2011, 2013, 2014, 2017; Robinson et al. 2010; Robinson et al. 2015; Waller 2006; and Waller and Robinson 2004a, 2004b) PAL also just completed in 2016-2017 additional archaeological sensitivity assessment, Phase I and Phase II terrestrial archaeological investigations of intertidal and upland areas on the eastern side of New Bedford Harbor/the Acushnet River where remediation impacts are anticipated onshore and along the shoreline (Elquist et al. 2017).

Secondary and supplemental marine archaeological site identification re-surveys of the marine and intertidal portions of the NBHSS Upper Harbor area by CR and DSRA (surveyed previously by JMA and Dolan) were initiated by the EPA and USACE-NAE following the 2009 unanticipated discovery of the submerged and buried remains of another historical wooden shipwreck dating from the late-eighteenth to early nineteenth century, termed here "NBHSS Shipwreck #1." Like NBHSS Shipwreck #2, NBHSS Shipwreck #1 was also encountered in the previously-surveyed and archaeologically-cleared Upper Harbor area of the NBHSS (Robinson and Wright 2011, 2013, 2014, 2017; Robinson et al. 2010). The intended purpose of the supplemental re-surveying the NBHSS Upper Harbor area has been to further reduce the chances of similar unanticipated discoveries of additional shipwrecks from occurring. In addition to the supplemental re-surveys of the NBHSS Upper Harbor area, DSRA (and Fathom Research, LLC, with which DSRA's principal was previously affiliated) has also provided on-call marine archaeological services to NBHSS for all subsequent unanticipated marine finds (e.g., anchors and other small artifacts) made since the 2009 unanticipated discovery of NBHSS Shipwreck #1.

The nature of the unanticipated discovery of NBHSS Shipwreck #2 is noteworthy, because it occurred in an area of the NBHSS that had been subjected to not only the original marine archaeological survey by Dolan, but also to the supplemental secondary, high-resolution marine archaeological re-survey by CR and DSRA. In the case of each survey, a detectable diagnostic presence typically associated with shipwreck sites, such as an area on the harbor floor with a visibly unusual surface texture or elevation change, or a clustered distribution of magnetic anomalies detected over multiple adjacent and closely-spaced survey track lines, was absent from the recorded side scan sonar and magnetometer data. Additionally, the gaseous nature of the harbor floor's sediments prevented acoustic penetration and acquisition of subbottom profiles, rendering it impossible to detect buried hull remains or ballast piles. The only remote sensing contact or anomaly that was recorded at the location of NBHSS Shipwreck #2 was a single, isolated, and unremarkable low-amplitude (5 gammas) and short-duration (10 feet [3 meters]) monopolar magnetic anomaly (M111), which was detected on just one of the closely-spaced supplemental secondary re-survey

track lines (Figure 2). New Bedford Harbor's long post-European contact history of early colonization, intensive maritime use, urbanization and industrialization led to the deposition of significant amounts of debris and trash into New Bedford Harbor's waters. The accumulation of these materials on the harbor floor has created a situation wherein literally thousands of isolated, low-amplitude, short-duration magnetic anomalies have been recorded during CR/DSRA's high-resolution supplemental secondary re-surveys of the Upper Harbor area. An isolated, single, low-amplitude, short-duration magnetic anomaly is analogous to a single star in a sky-full of similar stars, nearly all of which in the case of the NBHSS are caused by isolated debris or trash. If the subbottom profiler had been able to penetrate the gaseous sediments of the harbor floor, it is likely that some element or elements of the ship remains would have been visible in the subbottom profile, as has been seen in profiles recorded over shipwrecks in other study areas. However, absent of this subbottom data, and similar to the circumstances of NBHSS Shipwreck #1, NBHSS Shipwreck #2 was essentially undetectable. The noteworthiness of these findings is also a source of significant concern, both from the perspective of planning future marine archaeological identification surveys within the NBHSS and from a broader submerged cultural resource management perspective, as they indicate that there is a significant likelihood that older, less-well preserved, but potentially more historically significant, wooden shipwrecks that are buried beneath gaseous organic-rich sediments and whose ferrous metal elements are completely corroded, are likely to go undetected during standard, or even high-resolution, marine archaeological remote sensing identification surveys. The implications of these findings and their potential impact on the perceived efficacy of marine archaeological identification survey methods warrant further analysis and consideration by the research community, as well as by historic preservation officers of federal, state, and tribal agencies who are required to conduct NHPA Section 106-compliant identification surveys within submerged environments.

PROJECT DESCRIPTION AND HISTORY

Discovery of NBHSS Shipwreck #2 initiated the implementation of a set of procedures outlined in Jacobs's 2010 Unanticipated Discoveries Plan (UDP) that was developed specifically for the NBHSS after the unanticipated discovery of NBHSS Shipwreck #1 (Jacobs Engineering, Inc. 2010). In accordance with the UDP, Jacobs reported the find to the EPA and the USACE-NAE, and to DSRA, on July 6, 2016, less than 24-hours after its discovery. The NBHSS Shipwreck #2 find was described to DSRA by Jacobs as "a large timber…possibly having [attached to it] ribs… [and] boards with round 'peg like' holes in them." The position of the find was reported by Jacobs as 815398.47 / 2705752.03 (MA State Plane [feet]), a location centered within the Acushnet River inside the city limits of New Bedford near the northern edge of Jacobs's "2015 Task 2 (Submarine Cable Crossing) Area" of the NBHSS's Upper Harbor (Joshua Cummings [Jacobs], email to D. Robinson [DSRA], July 6, 2016). The unanticipated discovery of NBHSS Shipwreck #2 occurred when a portion of the find was brought to the water's surface and Sevenson's on-site staff immediately recognized it as something of potential archaeological significance and reported it to Jacobs. The find was kept immobile at the surface until its precise GPS position could be recorded and a photograph of it could be taken (Figure 3). The find was then lowered slowly back down into the water and onto the harbor floor with a temporary 250-foot- (76-meter-) radius work-exclusion zone established around it. Remediation work activities then resumed at a different location within the NBHSS outside of the newly-established exclusion zone (Cummings to Robinson, personal communication, July 6, 2016).

After being notified of the unanticipated discovery of NBHSS Shipwreck #2 and examining the photograph of the find, DSRA informed Jacobs that it did appear to be the remains of an historical wooden ship, probably similar in age, size and vessel type (i.e., a sailing ship rather than a motorized ship) to NBHSS Shipwreck #1. DSRA then advised Jacobs to: a) ensure that the MBUAR and the MHC were also notified of the find, (as stipulated in the NBHSS UDP), and; b) recommended that a science-based management approach for the site involving the collection of additional baseline engineering survey data be undertaken to inform and help guide the planning and execution of the archaeologically-guided, systematic removal and archaeological documentation of the NBHSS Shipwreck #2's wooden hull remains in a manner similar to that which was performed for the NBHSS Shipwreck #1 find. Preservation-in-place was not recommended as a management option for NBHSS Shipwreck #2, because the removal of its presumably contaminated wooden hull timbers and the surrounding contaminated harbor floor sediments is required to complete environmental remediation activities within the Upper Harbor area of the NBHSS (Robinson to Cummings, personal communication [email and telecom], July 6, 2016).

To obtain the necessary additional baseline engineering information to develop a science-based marine archaeological management response to the unanticipated discovery of NBHSS Shipwreck #2, DSRA recommended, and CR completed in July 2016, a more-detailed high-resolution sidescan sonar survey of an area fully encompassing and slightly larger than the 250-foot- (76-meter-) radius exclusion zone centered on the reported location of the find. DSRA also recommended that the track lines for this high-resolution survey be conducted on a grid pattern with additional lines run diagonally across the find site at multiple angles to provide multiple detailed sonar images of the now partially-disturbed and newly-exposed ship remains from a variety of vantage points. This engineering survey served dual purposes. First, it confirmed the adequacy of the size of the temporary exclusion zone and allowed DSRA to recommend to Jacobs its reduction to a 60 foot- (18 meters)-radius area based on the documented extent of the NBHSS Shipwreck #2 site. Second, it provided additional data necessary to begin developing a work plan for the archaeologically-guided systematic removal and documentation of the ship remains. On August 1, 2016, DSRA reported in an email to Jacobs its recommendations and that CR's new survey data indicated that the exposed wreckage occupied a relatively small area and might not constitute the remains of the bottom of a ship's hull preserved in its entirety from stem to stern (Robinson to Cummings, August 1, 2016).

On August 15, 2016, DSRA communicated via email again to Jacobs an additional recommendation for a second phase of detailed engineering survey to assess whether or not there were any additional elements of NBHSS Shipwreck #2 that were buried and, therefore, not visible in the acquired sidescan sonar data (Robinson to Cummings, August 15, 2016). DSRA's recommended survey methodology for identifying buried hull remains included additional remote sensing survey, consisting of subbottom profiling and magnetometry, as well as a systematic (i.e., on a 3-foot [1-meter] grid), differential global positioning system- (DGPS-) guided, "tile-probing" survey (i.e., sediment probing done with a thin metal rod fitted with a T-handle at its top from one of CR's small survey vessels with the locations of positive [for buried hull remains] and negative [no buried hull remains] probe results mapped with GPS and plotted in a site plan of correlated remote sensing data). CR commented that the magnetometer survey would be redundant and not likely to provide much additional information than the detailed magnetic data already acquired for the site during the 2016 re-survey of the 2015 Task 2 (Submarine Cable Crossing) Area.

Based on their comment, this additional phase of more-detailed baseline engineering survey included just the subbottom profiling and probing field investigations.

Processed data provided to DSRA for review by CR from these more-detailed baseline engineering surveys of the NBHSS Shipwreck #2 find site indicated that the wooden vessel's hull remains include portions that are exposed and buried, and together extend horizontally along their longitudinal axis a distance of approximately 45 to 50 feet (14 to 15 meters) (Figures 4 and 5). About half of the hull remains documented through tile-probing are currently buried beneath approximately 3 feet (1 meter) or less of harbor floor sediment. Although they are likely to be within the remediation dredging prism at this location, they were completely invisible to the sidescan sonar. The remainder of the preserved hull elements, which were lifted out of the sediments when they were initially encountered during debris-removal operations, is now exposed above the harbor floor and visible in the more detailed sidescan sonar survey record that was made after the wreck was encountered (see Figure 5). Based on the relatively narrow width of the mapped hull remains, it appears that the NBHSS Shipwreck #2 find constitutes only a portion of the vessel's hull, perhaps the lower part of one side, extending from its turn-of-bilge where the hull transitions from its side to its bottom. This kind of preservation (i.e., the lowest part of a tilted hull that settled to the bottom and was then buried relatively quickly in anaerobic sediments, protecting it from colonization and destruction by damaging marine life) is not atypical. The acquired survey data also indicated that the types of materials that are preserved at the site include a portion of a vessel's wooden hull, but likely little else of the ship. Iron fasteners and any other ferrous hull components, hardware or cargo, do not appear to be present, based on currently available data. This result is similar to what was observed in the remote sensing data associated with, and in the recovered materials from, NBHSS Shipwreck #1 – that is, that all of its iron fastenings and other iron hull components were corroded to the point where they no longer possessed any ferrous mass detectable with a magnetometer as a single anomaly, or collection of anomalies, of significant size or duration.

CR's surveys and DSRA's review and interpretation of the data from these more-detailed baseline engineering surveys resulted in management recommendations for addressing the NBHSS Shipwreck #2 unanticipated discovery that were presented to Jacobs, the EPA and the USACE-NAE in an internal Draft Memorandum Report prepared by DSRA and submitted in February 2017. The remainder of this Draft Work Plan presents the details of DSRA's proposed recommended research tasks for the archaeologically-guided removal and archaeological documentation of the NBHSS Shipwreck #2 unanticipated discovery. These proposed tasks were developed based on the results of the more-detailed surveys, our experiences from working on NBHSS Shipwreck #1, and the tasks included in the scope-of-work that was prepared by Jacobs in February 2017 from which CR and DSRA developed their project cost estimates.

PROPOSED RESEARCH TASKS

Task 1: Coordination/Consultation

DSRA President & CEO, David S. Robinson, M.A., R.P.A., will serve as the Project's qualified marine archaeologist and principal investigator. DSRA will coordinate with and provide consultation services to CR, Jacobs, the EPA and the USACE-NAE, as directed by CR and Jacobs, to assist the EPA and the USACE-NAE in their technical communications and consultation with other federal, state, tribal, and local agencies, and interested parties (e.g.,

New Bedford Historical Commission, the Waterfront Historic Area League in New Bedford, the New Bedford Whaling Museum, and the National Park Service's New Bedford Whaling National Historic Park) related to compliance with the NHPA's Section 106, and other federal and state laws pertaining to project-related cultural resource management issues. DSRA will attend and participate in a preparatory meeting with CR, Jacobs, the EPA and the USACE-NAE staff prior to the initiation of field operations, as well as in any other meetings that we are requested to attend and participate in during the course of the project.

Task 2: MBUAR Special Use Permit No. #14-001 Revision and Submittal

Upon finalization of this marine archaeological work plan, DSRA will coordinate with MBUAR and prepare and submit the necessary documentation to revise DSRA's existing MBUAR Special Use Permit No. #14-001, in accordance with 312 CMR 2.06(1)(c). Copies of the revised MBUAR Special Use Permit documentation will also be copied to CR, Jacobs, the EPA, the USACE-NAE, the MHC (i.e., SHPO) and the tribes for their review and files.

Task 3: Supplemental Research

DSRA will perform, as necessary, supplemental research to identify to the extent possible the vessel type, purpose and identity of NBHSS Shipwreck #2 and . Sources of information likely to be consulted include archival documentation assembled during the investigation of NBHSS Shipwreck #1, relevant cultural resource management reports, site files, and State and National Register files of the MHC and MBUAR, NOAA's AWOIS (Automated Wreck and Obstruction Information System), the *Encyclopedia of American Shipwrecks* (Berman 1972), historical charts and maps of the area, published and unpublished primary and secondary sources on the area's history, and information gained from informal interviews with local persons knowledgeable about New Bedford's maritime history.

Task 4: Archaeological Monitoring of Removal, Transport & Storage of Ship Timbers

DSRA's Principal Investigator will help coordinate and monitor in the field the archaeologically-guided removal, transport and temporary storage of NBHSS Shipwreck #2's individual hull timbers. Removal will be accomplished by Sevenson using: a Komatsu PC-220 machine with an "Add-A-Stick" extension and hydraulic rake attachment (or equivalent) and operator on a 40-x-40-foot- (12-x-12-meter-) long deck-barge fitted with spuds; a work boat and an operator; two 50-cubic yard (38-cubic meter) hopper-barges or scows for containment of recovered debris and shipwreck materials (one of which will be partially filled with water to keep recovered timbers wet prior to their transfer and storage onshore, and the other of which will be kept dry and will be for recovered materials deemed by DSRA to be unrelated debris or shipwreck elements in too poor of a condition to be identifiable or worthy of detailed documentation); and a gas-powered water pump and hose for gross decontamination of the timbers as they are recovered and brought onto the deck-barge for their initial photo-documentation and sorting.

DSRA will communicate directly with the machine operator to ensure that the removal of NBHSS Shipwreck #2's individual hull components is done in as systematic a manner as possible, progressing from one end of the vessel to the other. This systematic approach will better ensure that all of the shipwreck's remains have been removed as the process progresses, as well as facilitate and enhance DSRA's analysis, interpretation and "on-paper" reconstruction of the recovered hull remains. DSRA will maintain a field notebook in which they will record information concerning the dates and times they worked on-site, personnel who were involved, the details and progress of the removal process, and an inventory of items that were recovered and retained. Individual timbers will be recovered initially onto

the deck barge for DSRA to determine whether they will be retained for detailed documentation or simply discarded. If the former option is selected, than gross-decontamination, preliminary photo-documentation, and transfer to the nearby water-filled barge will occur. This process will be repeated until DSRA and Sevenson have determined that all of NBHSS Shipwreck #2 has been removed.

Once DSRA and Sevenson have determined that all of NBHSS Shipwreck #2's hull remains has been removed, the water-filled barge with the recovered timbers will be moved to the NBHSS pier. Water in the barge will then be pumped out and individual timbers will be removed from the barge to the pier where they will be wrapped in polyethylene sheeting secured with duct-tape and labeled with identification information, and then transferred a short distance to an onshore temporary storage location (i.e., "the pad") within the NBHSS where the detailed archaeological documentation task will occur.

Task 5: Archaeological Documentation of NBHSS Shipwreck #2's Hull Remains

Recovered ship timbers and other material culture finds associated with NBHSS Shipwreck #2 will be subjected to detailed documentation, analysis, and interpretation utilizing the same methods that were employed for NBHSS Shipwreck #1. Documentation (i.e., documentation performed in addition to that which was completed during recovery operations) will consist of digital scale photographs and measured scale drawings of the dimensions, shapes and surface details of each individual timber (in plan and profile). Each timber will be analyzed and interpreted (to the extent possible) to determine its function and place within the vessel's hull. Wood species identification, which can provide an indication of where the vessel was built and repaired, will also be attempted on select representative examples of each recovered hull component (e.g., stem, deadwood, keel, sternpost, frames (floors and futtocks), keelson, ceiling, planking, treenails, etc.).

Task 6: Reporting

DSRA will prepare and submit electronically to CR, Jacobs, EPA and the USACE-NAE for review and comment an internal draft marine archaeological report upon completion of Project Tasks 3, 4 and 5 (i.e., supplemental research and removal and documentation of NBHSS Shipwreck #2's hull remains). Upon DSRA's receipt of internal comments, the electronic version of an external draft report will be prepared and submitted to CR and Jacobs for production and external distribution. Upon receipt of external reviewer comments, an electronic copy of the final report addressing those comments will be prepared and submitted to CR, Jacobs, the EPA and the USACE-NAE for external distribution and archiving.

The reports will include the following elements:

- Introduction
- Research Design and Methodology
- Results of the Supplemental Research and Field Documentation
- Summary and Recommendations
- References
- Tables
- Figures
- Appendices

The report's contents and format will follow the reporting guidelines established by the National Park Service in the Recovery of Scientific, Prehistoric, Historic, and Archeological Data (36 CFR Part 66 Appendix A), MHC's *Historic Properties Survey Manual: Guidelines for the Identification of Historic and Archaeological Resources in Massachusetts* (1992), and MBUAR Regulations (312 CMR 2).

HEALTH AND SAFETY PROTOCOLS

DSRA's planned marine archaeological fieldwork will involve working onboard either CR's, Jacob's, and/or Sevenson's survey vessels, workboats, and deck barges. This fieldwork, as well as the onshore shipwreck timbers documentation on-site fieldwork, will be conducted in close proximity to and, at times, in direct contact with the contaminated recovered remains of NBHSS Shipwreck #2 and their associated contaminated sediments. *DSRA will adopt and comply with the Jacobs Project Health and Safety Plan for the NBHSS throughout the duration of its field investigations.*

DSRA fieldwork performed onsite at the NBHSS will be conducted wearing Level D personal protective equipment (PPE). This PPE will include, at a minimum, safety vest, hard hat, safety glasses, steel toe boots, shirt with sleeves and long pants. For fieldwork conducted during the shipwreck timbers recovery phase of the project, DSRA personnel will wear "modified" Level D PPE consisting of hard hat, safety glasses, disposable Tyvek coveralls, steel-toe boots with disposable protective rubber over-boots, and nitrile gloves (i.e., inner and outer gloves when handling ship timbers). The disposable Tyvek coveralls, rubber over-boots and nitrile gloves will be provided to DSRA by Jacobs. Additionally, the requisite PPE for all work conducted within 5 feet (2.5 meters) of the water's edge, or on any floating plant will also include a personal flotation device (PFD). All of DSRA's archaeological field staff working on the project will have undergone 40-hour HAZWOPER training, have previous experience working on HAZMAT sites, have undergone the requisite 8-hour refresher training within the last year, and have physician certification for the ability to work on a hazardous waste site, per OSHA regulation 29 CFR 1910.120. They also will hold current certifications in first aid and CPR. Documentation of this training and the associated certifications will be provided to CR and Jacobs prior to the initiation of DSRA's active participation in field activities. All DSRA on-site field personnel will sign in and out using the Daily Sign-In book located at the reception desk in the Jacobs trailer at the front of the NBHSS. All DSRA on-site field personnel will also check in with Jacobs personnel as notification of presence on site and to receive an update to any specific requirements for work to be performed. DSRA's on-site field personnel will also assist the Jacobs Site Safety and Health Officer in complying with foul weather preparedness procedures, as needed and directed.

PROJECT SCHEDULE

Task 1 will be on-going throughout the Project. Task 2 will be completed within five business days of DSRA's receipt from CR of a formal notice-to-proceed on the project. Task 3 will be on-going throughout the project. Task 4 will be accomplished within an approximately two week period and is projected to start on an as-yet determined date sometime in July 2017. Task 5 is anticipated to take approximately 20 ten hours-long field-days to complete, which we be completed over the late summer and into early fall. The internal draft report element of Task 6 will be completed within an 80-hour period spread out over approximately 90 days. Completion schedules for the external Draft and Final

Report deliverables will be dependent upon receipt of comments from internal and external Project reviewers.

PROJECT PERSONNEL

Qualified marine archaeologist, David Robinson, M.A., R.P.A., president & CEO of DSRA, will serve as the marine archaeological project manager/principal investigator for the Project. Mr. Robinson has 26 years of professional supervisory and field experience conducting similar types of marine archaeological investigations throughout the mid-Atlantic and Northeast regions. Since 2003, he has served as a principal investigator on multiple marine and terrestrial archaeological investigations conducted in the NBHSS on behalf of the EPA and USACE-NAE, including the marine archaeological investigation of the 2009 unanticipated discovery NBHSS Shipwreck #1. He will perform/oversee all aspects of the Project's administration, fieldwork and the preparation of Project deliverables. Mr. Robinson's professional qualifications meet standards established by the National Park Service (36 CFR Part 66, Appendix C). Mr. Robinson may be assisted in the fieldwork occasionally during the shipwreck remains documentation task (Task 5) by a DSRA marine archaeological field specialist.

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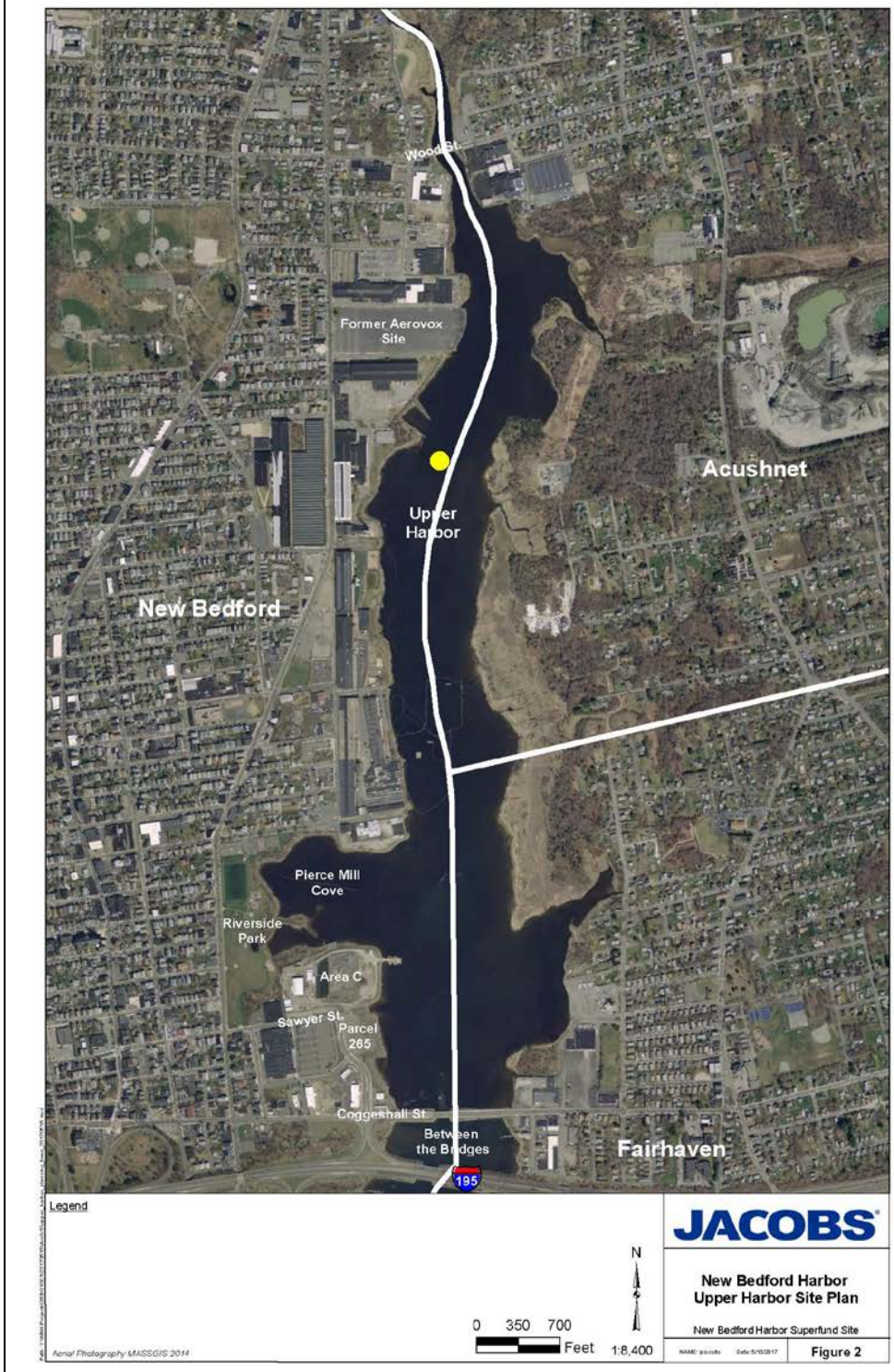


Figure 1. Plotted location (yellow circle) of the NBHSS Shipwreck #2 unanticipated discovery within the New Bedford city limits of the NBHSS Upper Harbor area (figure provided by Jacobs).

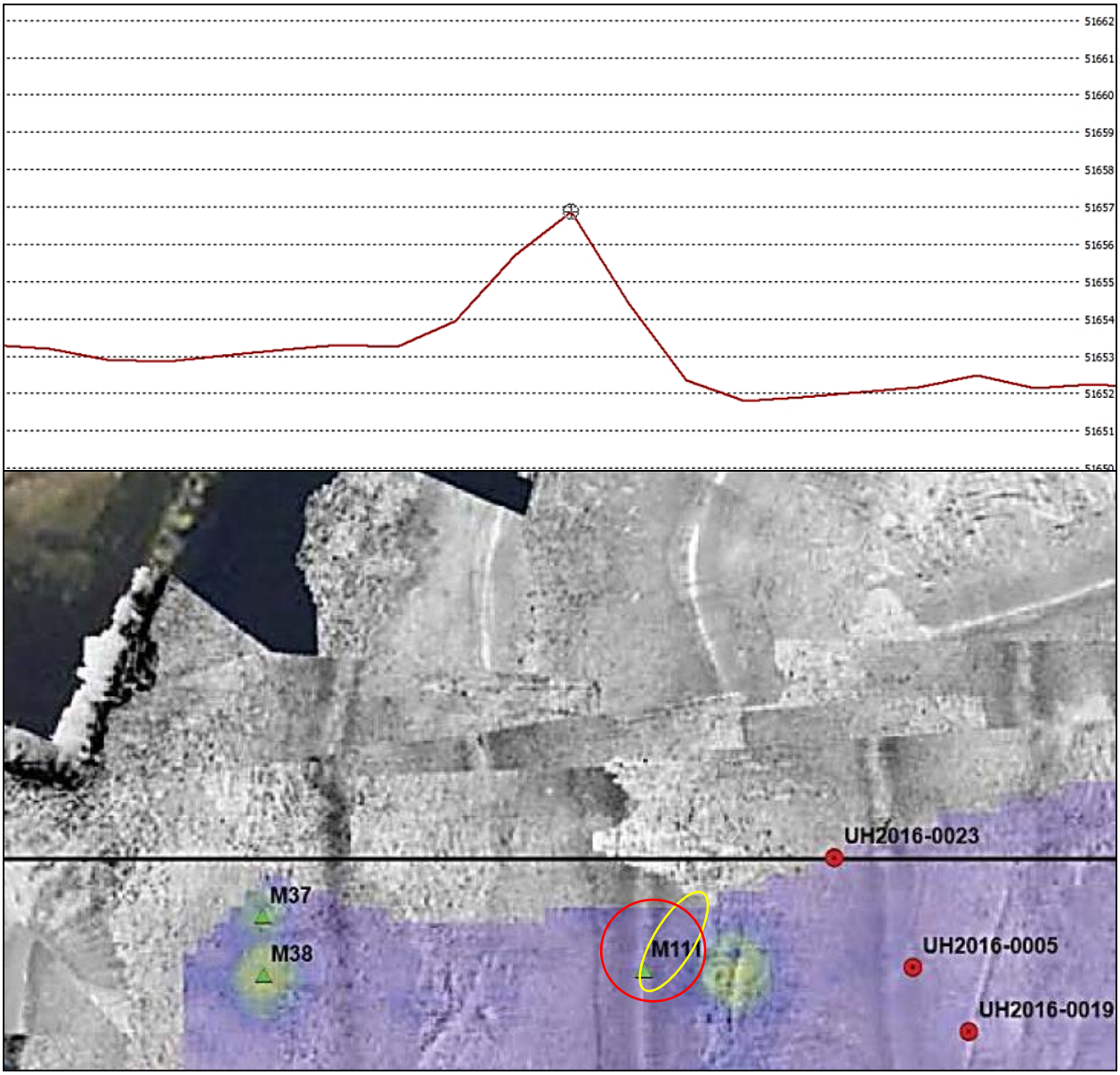


Figure 2. Raw data and processed data plots from the 2015 Task 2 (Submarine Cable Crossing) Area detailed re-survey showing the single, isolated, low-amplitude (4.5 gammas), short-duration (10 feet [3 meter]), monopolar magnetic anomaly (M111) (top image), and excerpted plot of a sidescan sonar mosaic base-map with overlying magnetic color-contour and point-plot of magnetic anomalies in the area of the NBHSS Shipwreck #2 find (outlined in yellow), as recorded <u>prior</u> to its unanticipated discovery, showing no visible sidescan sonar contact at its location (base images for figure provided by CR).

Figure σ. NBHSS Shipwreck #2 unanticipated discovery exposed during the debris removal phase of remediation activities within the of the 2015 Task 2 (Submarine Cable Crossing) Study Area of the NBHSS Upper Harbor (photograph by Joshua Cummings, Jacobs).

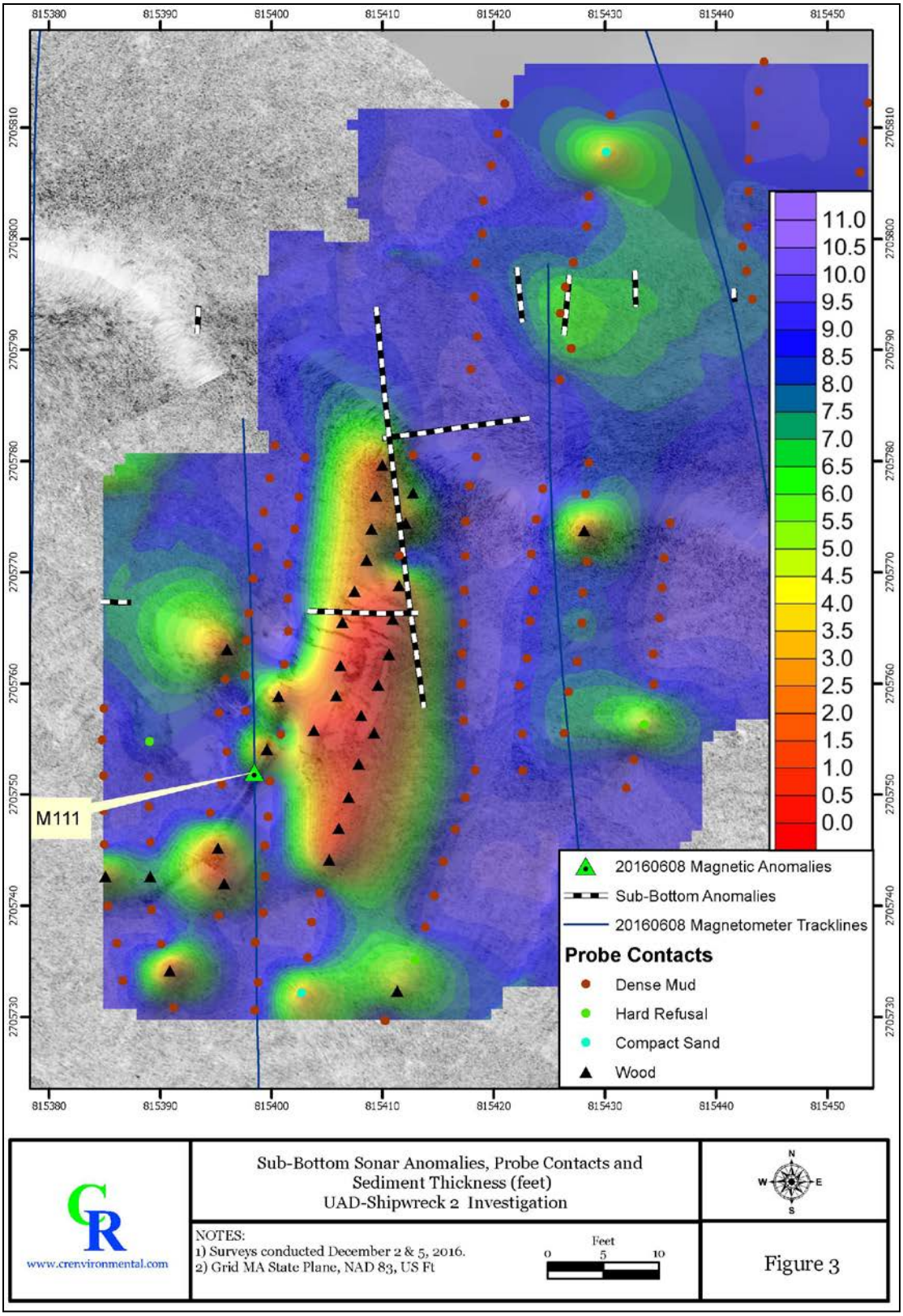


Figure 4. Plot showing results of 2016 tile-probing survey superimposed onto the color-contoured depth of sediment thicknesses over the buried portions of the NBHSS Shipwreck #2 find site (figure courtesy of CR).

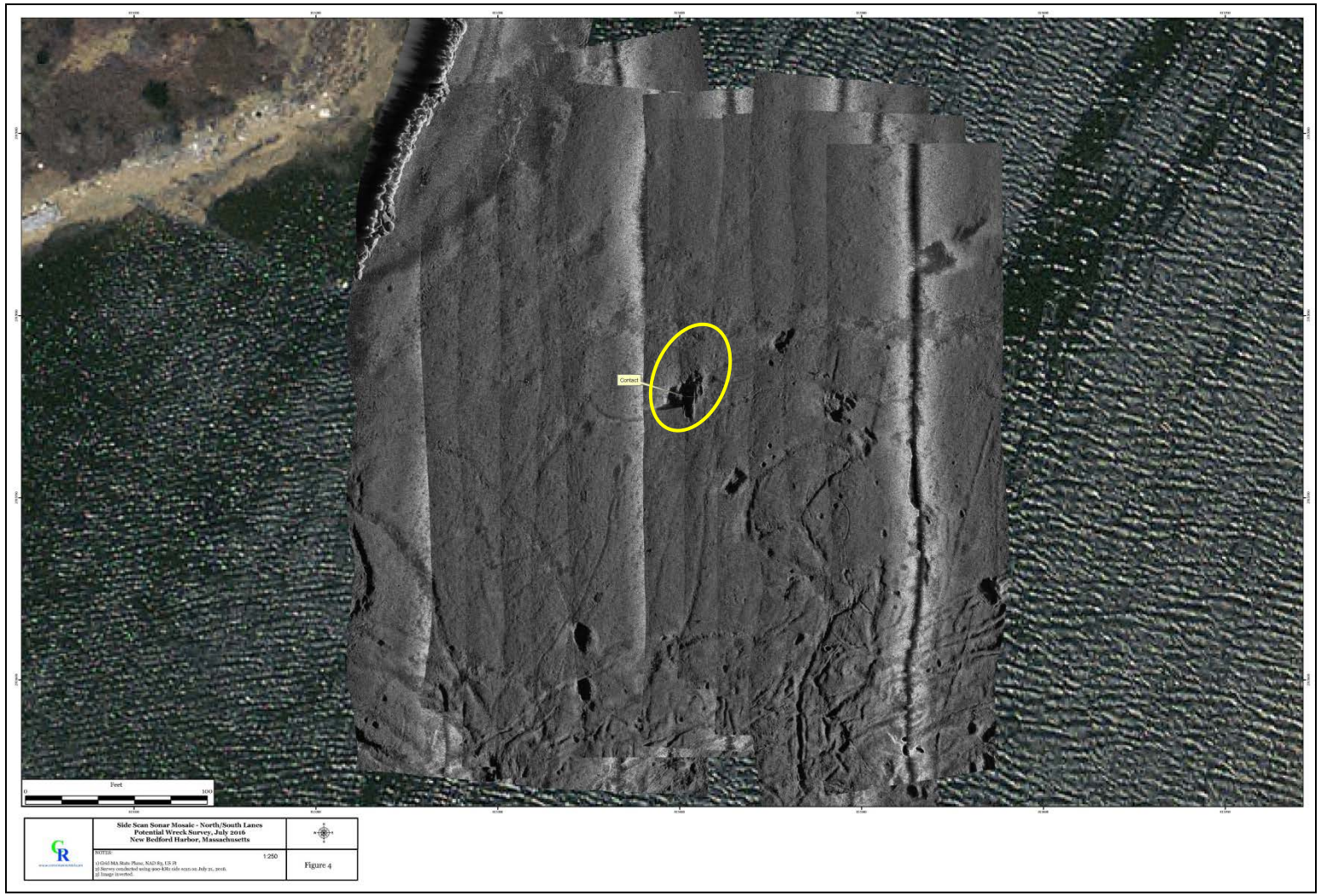
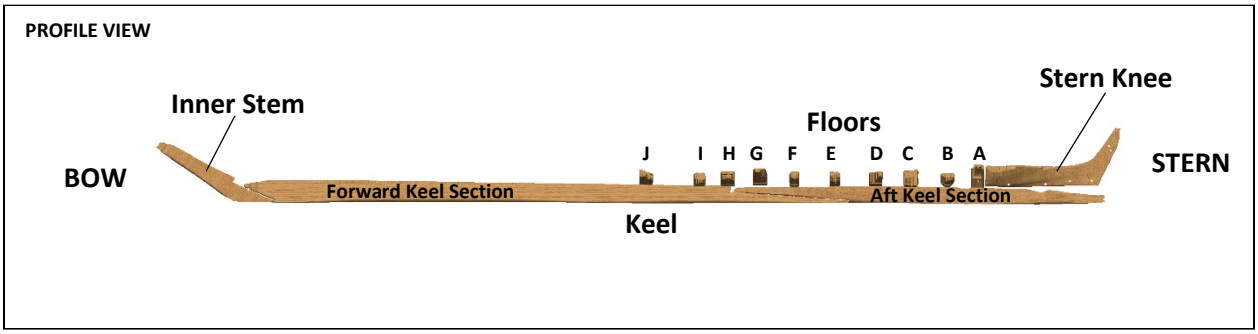


Figure 5. Sidescan sonar mosaic from the 2016 post-discovery detailed survey of the NBHSS Shipwreck #2 find site. The labeled sonar 'contact' represents the ship remains exposed by debris removal remediation activities. The yellow oval is the approximate limit of the archaeological deposit – note that its buried northern half detected through sub-surface probing (see Figure 4) is invisible in the sonar record (base figure courtesy of CR).

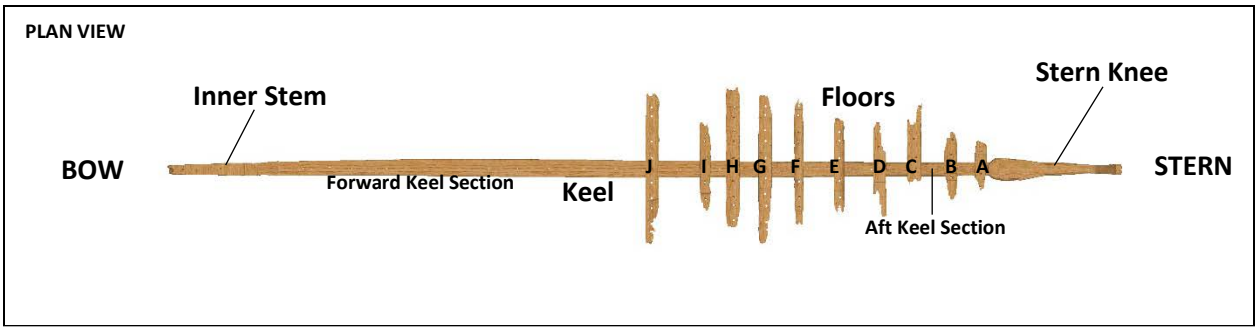
APPENDIX D

NBHSS UAD SW#2 DOCUMENTATION: PHOTOGRAPHS & DRAWINGS

TIMBER ARRANGEMENT KEY*

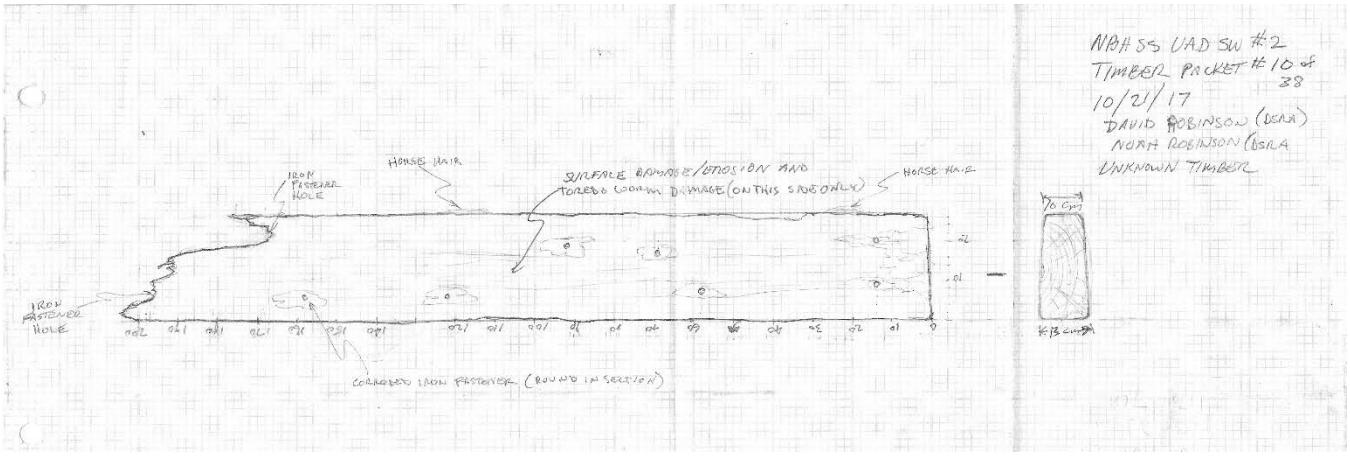


(* Recovered keel shoe, possible stern deadwood, futtocks, and hull planking are not included in the key)

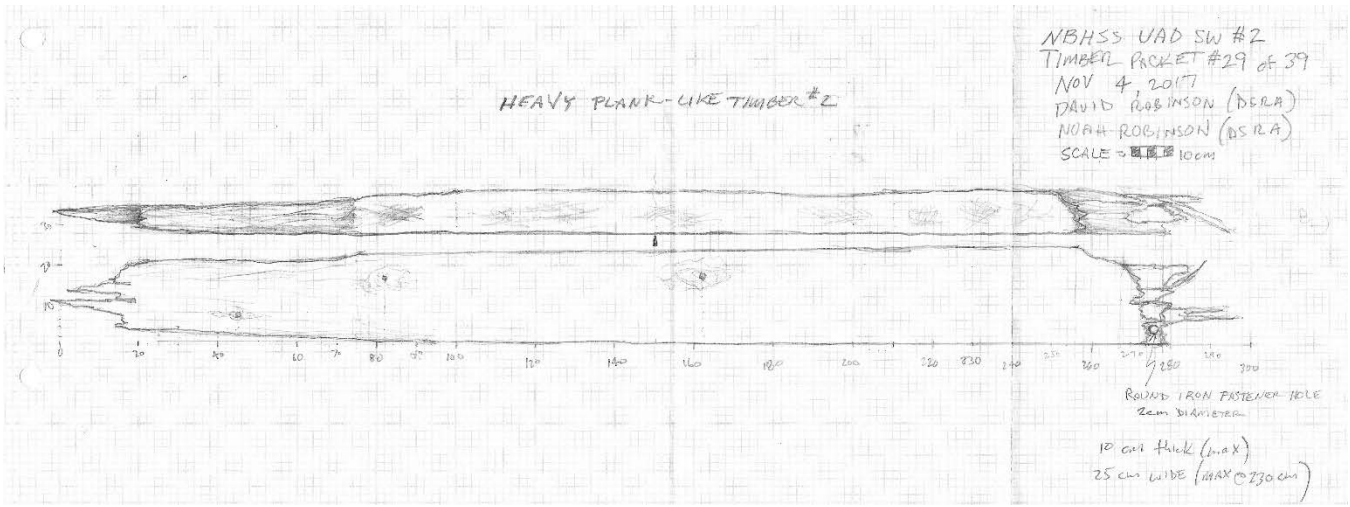


KEEL SHOE

KEEL SHOE
(FRAGMENT 1)

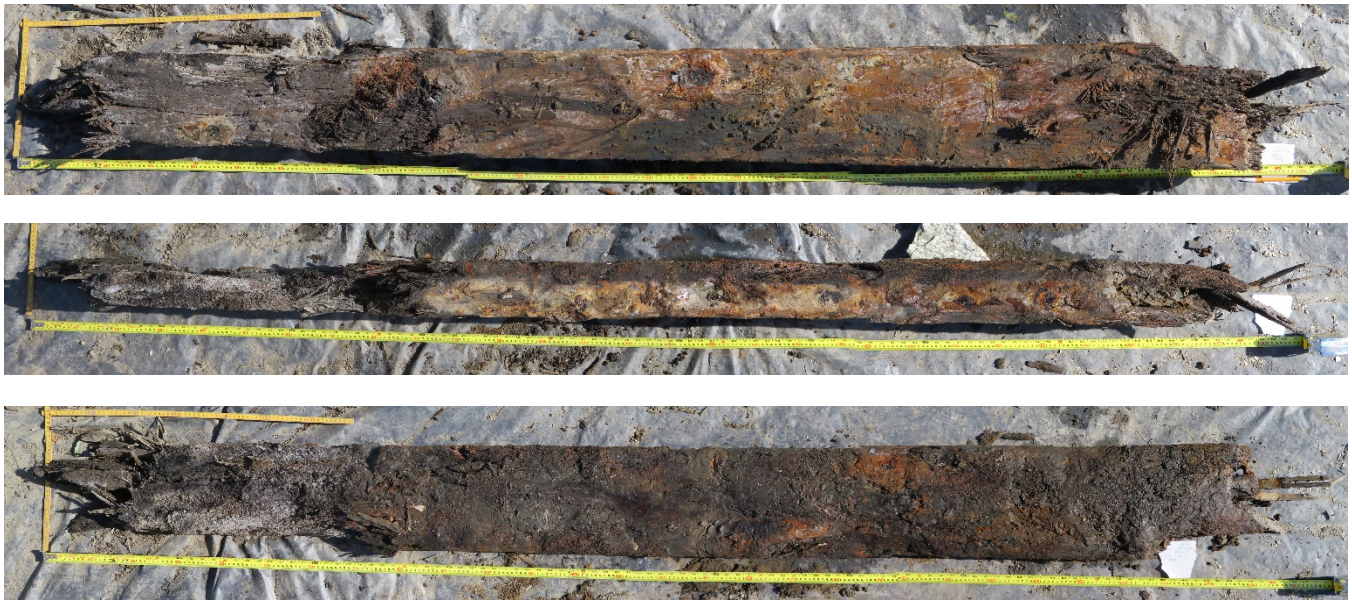


KEEL SHOE
(FRAGMENT 2)

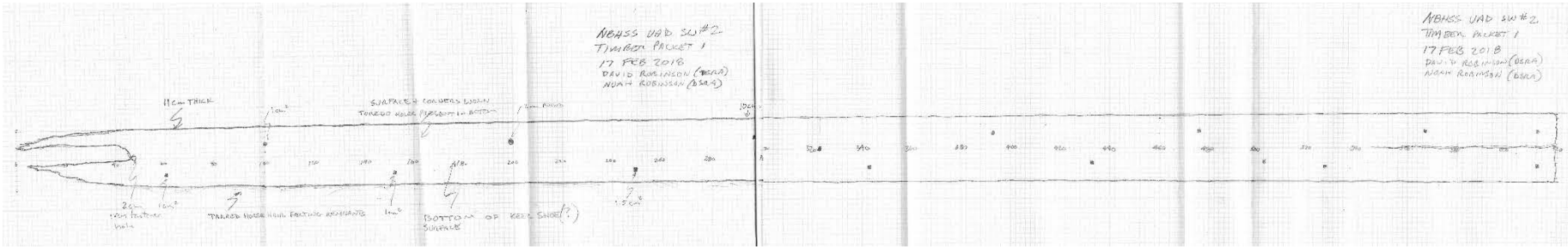


KEEL SHOE
(FRAGMENT 1)

KEEL SHOE
(FRAGMENT 2)



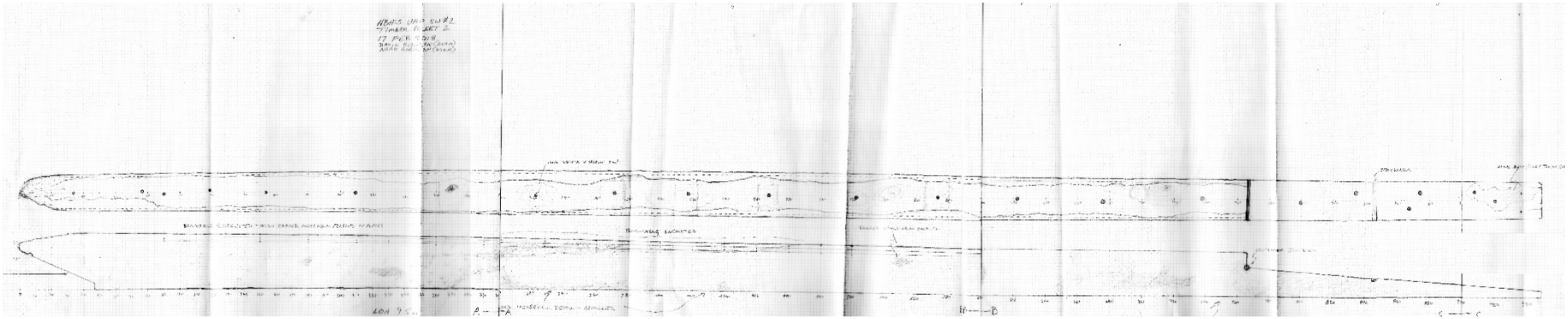
KEEL SHOE
(FRAGMENT 3)



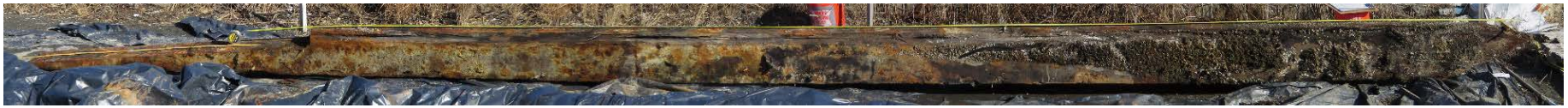
KEEL SHOE
(FRAGMENT 3)

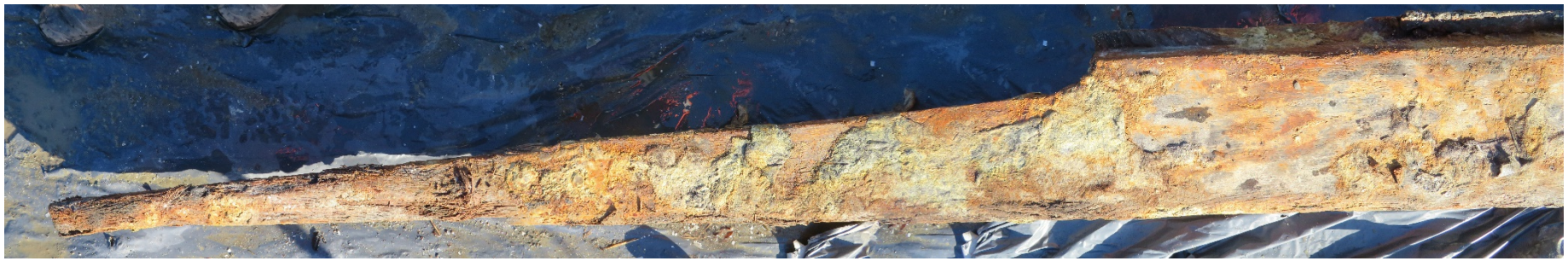
KEEL

KEEL
(FORWARD SECTION)

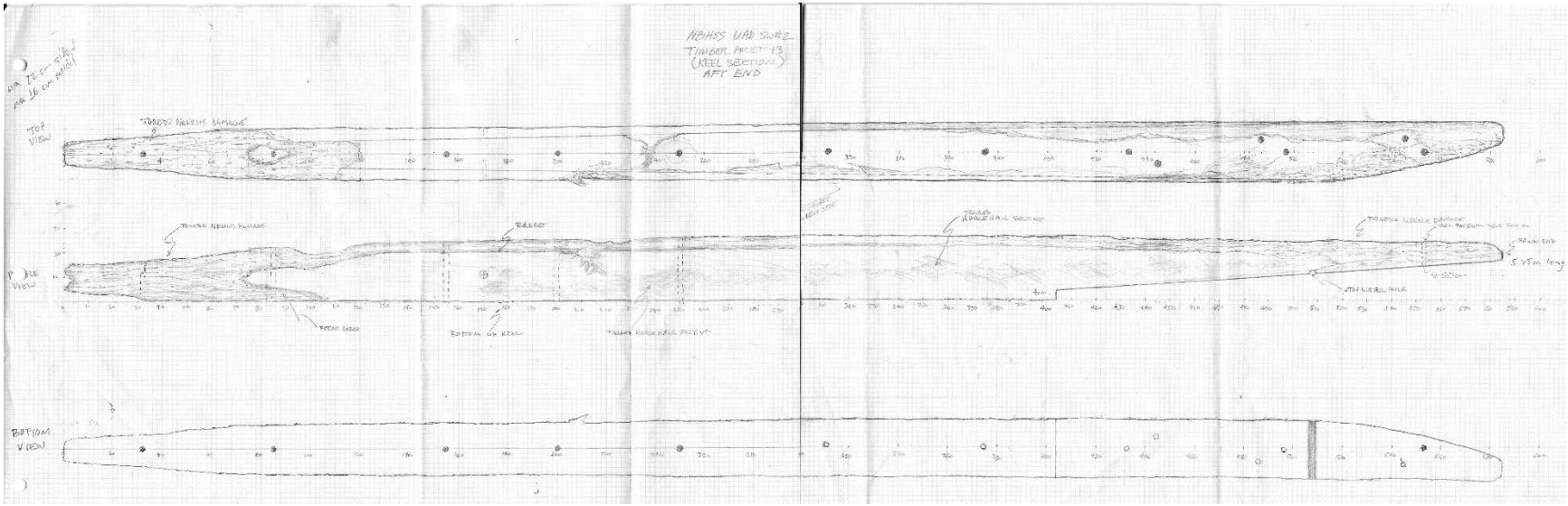


KEEL
(FORWARD SECTION)





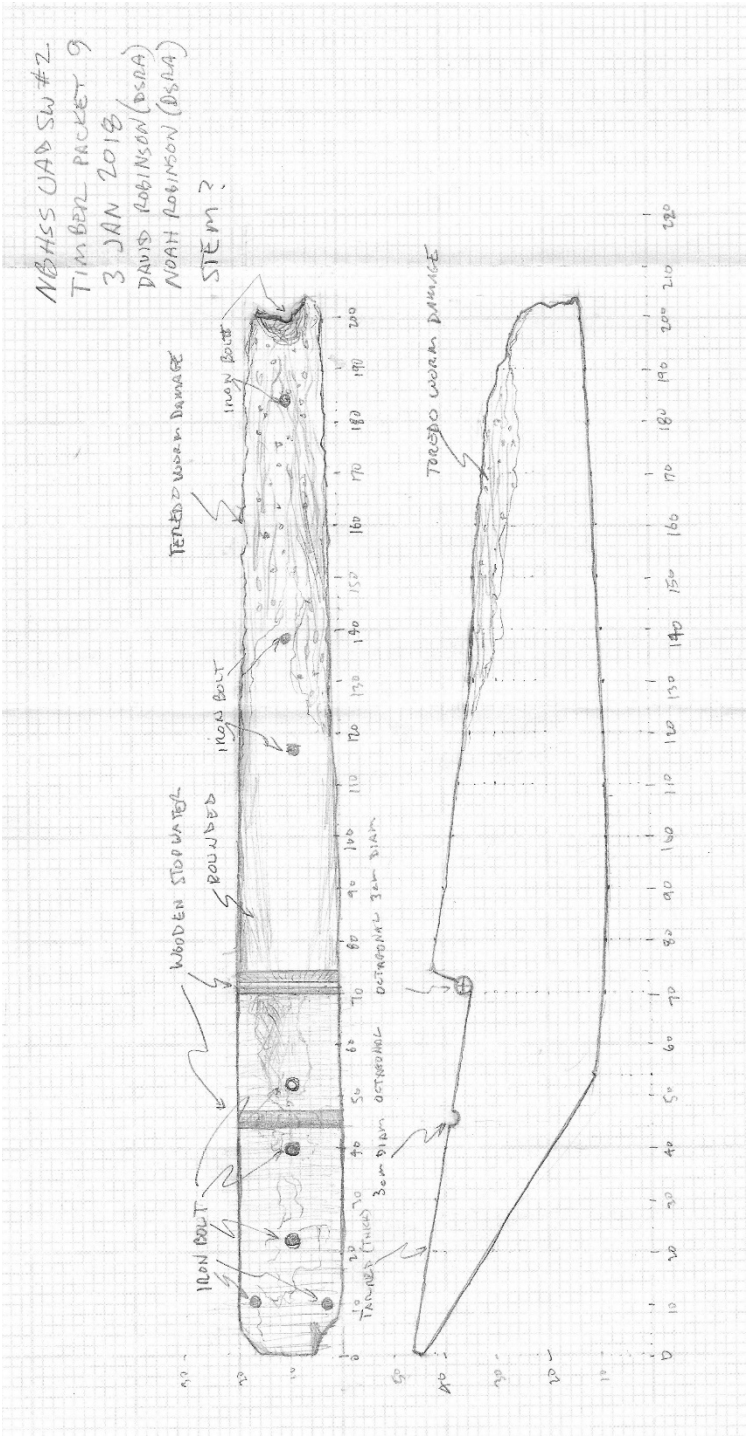
KEEL
(AFT SECTION)



KEEL
(AFT SECTION)

INNER STEM

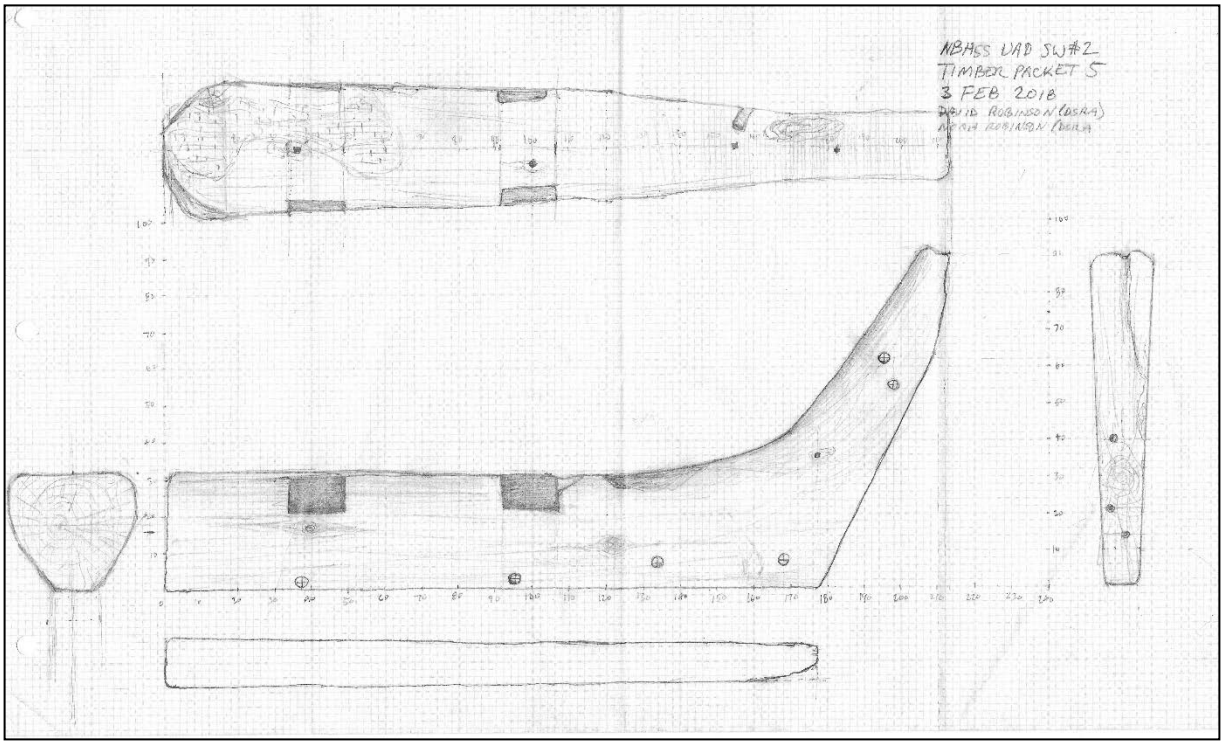
INNER STEM


NBHSS UAB SW#2
TIMBER PACKET 9
3 JAN 2018
DAVID ROBINSON (DSRA)
NOAH ROBINSON (DSRA)
STEM ?
IRON BOLT
TEREDO WORM DAMAGE
IRON BOLT
WOODEN STOP WATER
BOUNDED
IRON BOLT
TAPERED (THICK) TO
30cm DIAM OCTAGONAL
TEREDO WORM DAMAGE

INNER STEM

STERN KNEE

STERN KNEE

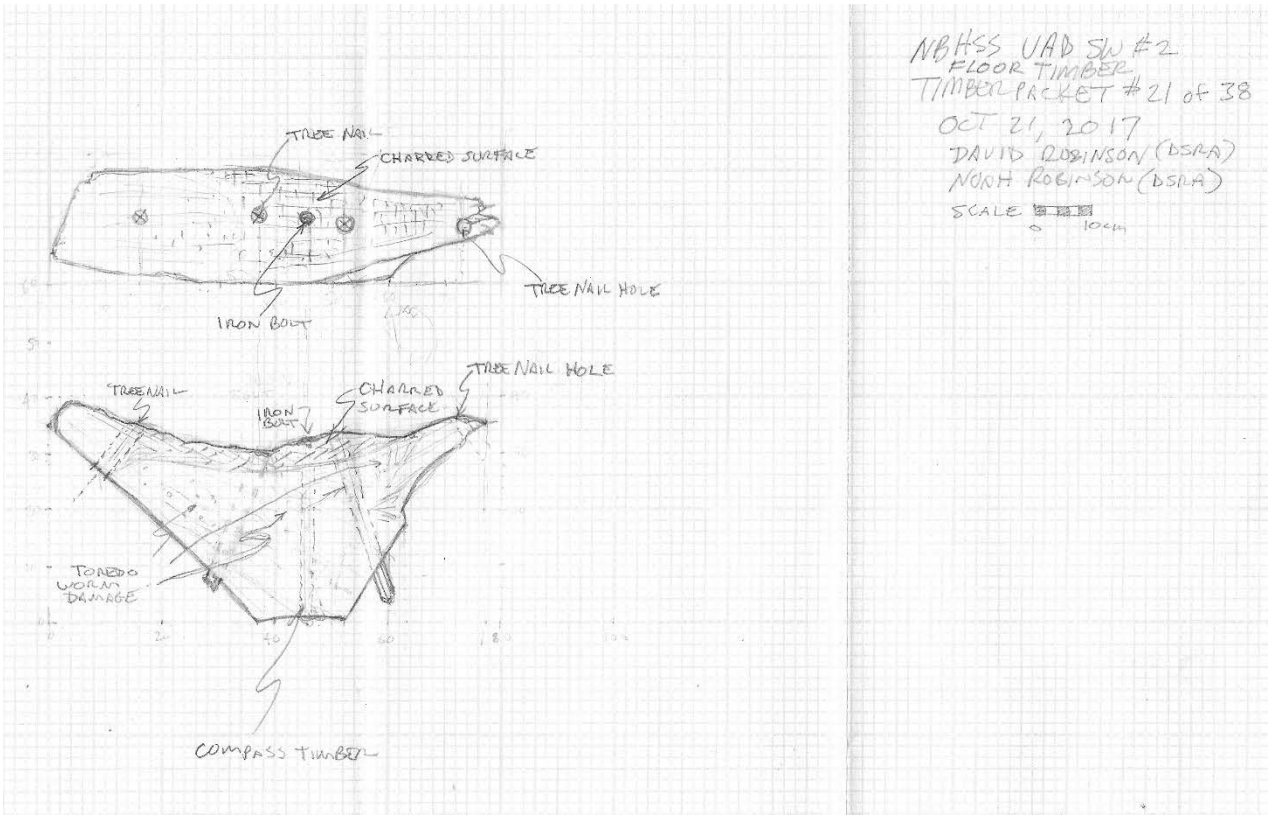


STERN KNEE

FLOORS

FLOOR A

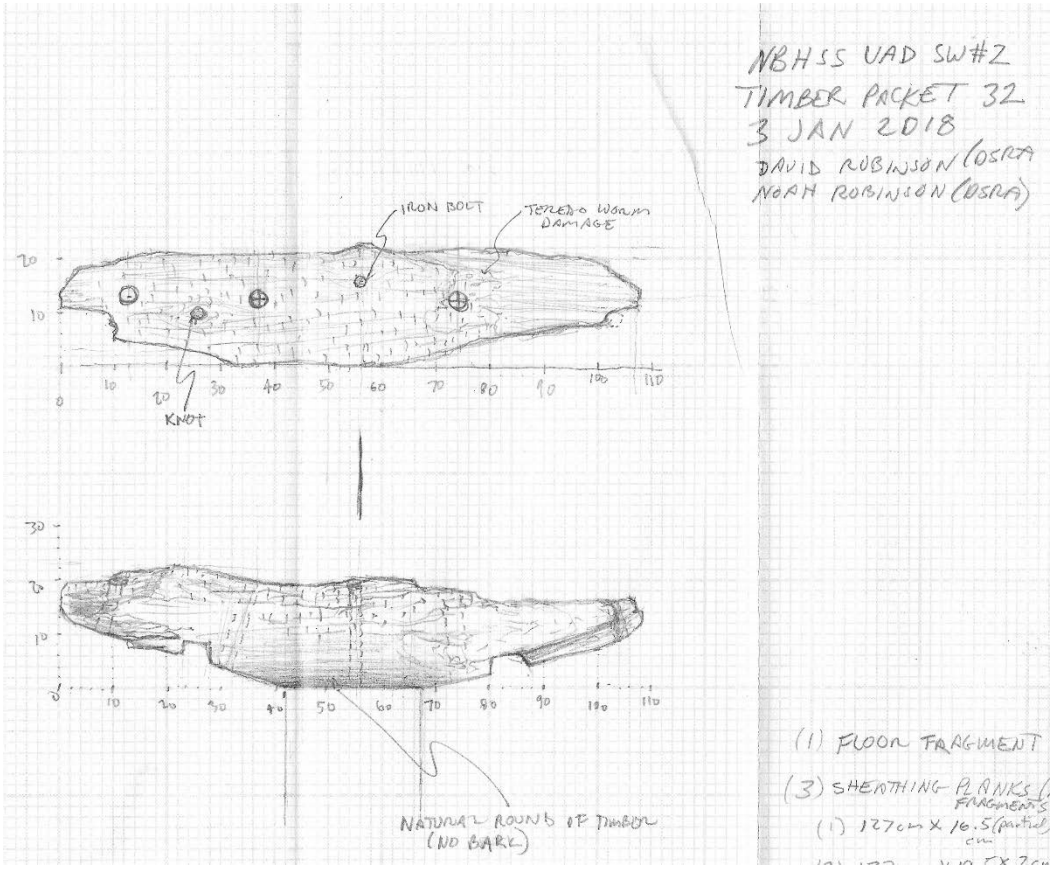
FLOOR A


NBHSS UAD SW #2
FLOOR TIMBER
TIMBER PACKET #21 of 38
OCT 21, 2017
DAVID ROBINSON (DSRA)
NORM ROBINSON (DSRA)
SCALE
0 10cm
TREE NAIL
CHARRED SURFACE
TREE NAIL HOLE
IRON BOLT
TREE NAIL HOLE
TREENAIL
IRON BOLT
CHARRED SURFACE
TOREDO WORM DAMAGE
COMPASS TIMBER

FLOOR A

FLOOR B

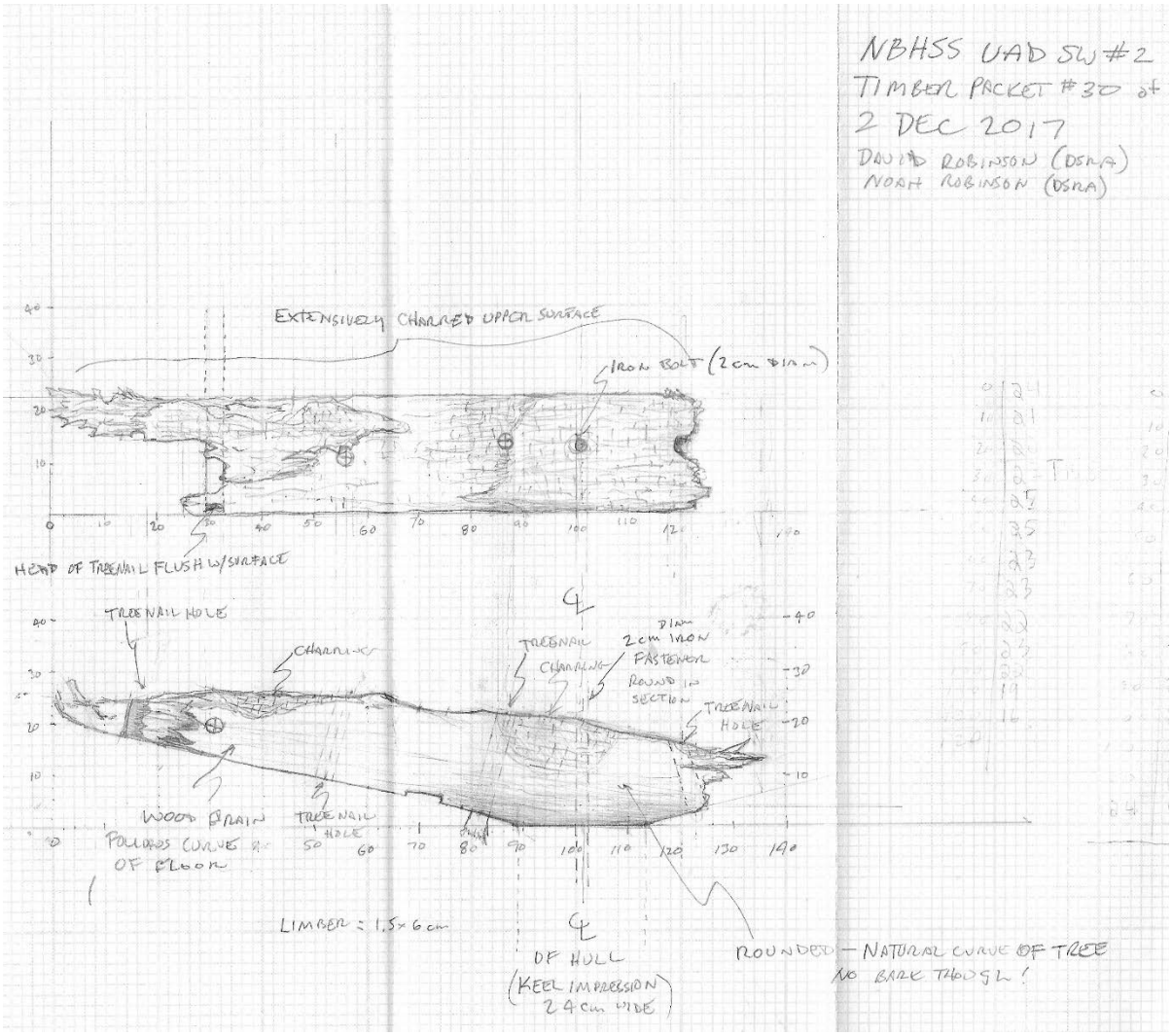
FLOOR B


NBHSS UAD SW#2
TIMBER PACKET 32
3 JAN 2018
DAVID ROBINSON (OSRA)
NOAH ROBINSON (OSRA)
IRON BOLT
TEREDO WORM DAMAGE
KNOT
NATURAL ROUNDS OF TIMBER (NO BARK)
(1) FLOOR FRAGMENT
(3) SHEATHING PLANKS (FRAGMENTS)
(1) 127cm X 16.5(partial) cm

FLOOR B

FLOOR C

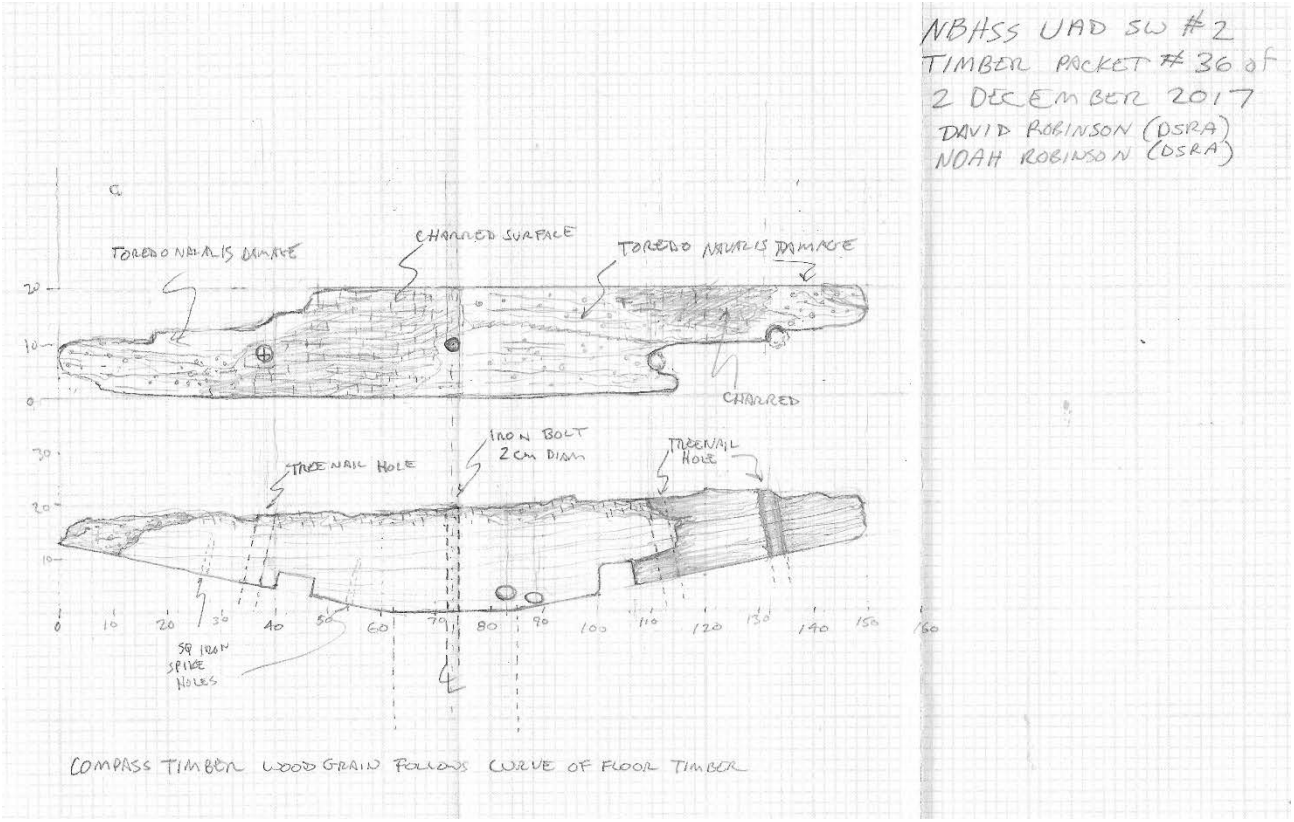
FLOOR C


NBHSS UAD SW #2
TIMBER PACKET #30 of
2 DEC 2017
DAVID ROBINSON (DSHA)
NOAH ROBINSON (DSHA)
EXTENSIVELY CHARRED UPPER SURFACE
IRON BOLT (2cm Diam)
HEAD OF TREENAIL FLUSH W/SURFACE
TREENAIL HOLE
CHARRING
TREENAIL
CHARRING
Diam 2cm IRON FASTENER ROUND IN SECTION
TREENAIL HOLE
WOOD GRAIN FOLLOWS CURVE OF FLOOR
TREENAIL HOLE
LIMBER = 1.5 x 6 cm
℄ OF HULL (KEEL IMPRESSION 24cm WIDE)
ROUNDED — NATURAL CURVE OF TREE NO BARK THOUGH!

FLOOR C

FLOOR D

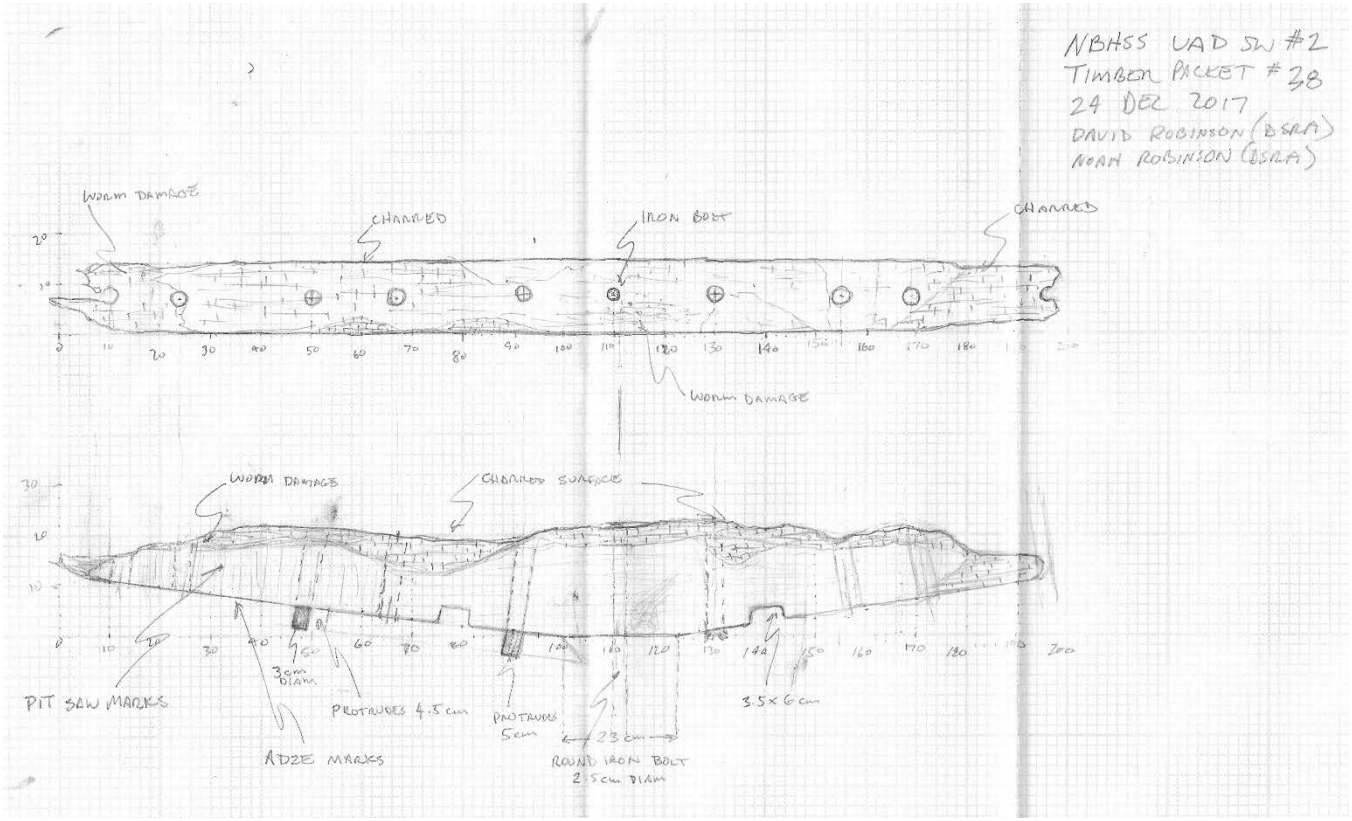
FLOOR D


NBHSS UAD SW #2
TIMBER PACKET # 36 of
2 DECEMBER 2017
DAVID ROBINSON (DSRA)
NOAH ROBINSON (DSRA)
TOREDO NAVALIS DAMAGE
CHARRED SURFACE
TOREDO NAVALIS DAMAGE
CHARRED
IRON BOLT
2 CM DIAM
TREENAIL HOLE
TREENAIL HOLE
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160
59 IRON SPIKE HOLES
COMPASS TIMBER WOOD GRAIN FOLLOWS CURVE OF FLOOR TIMBER

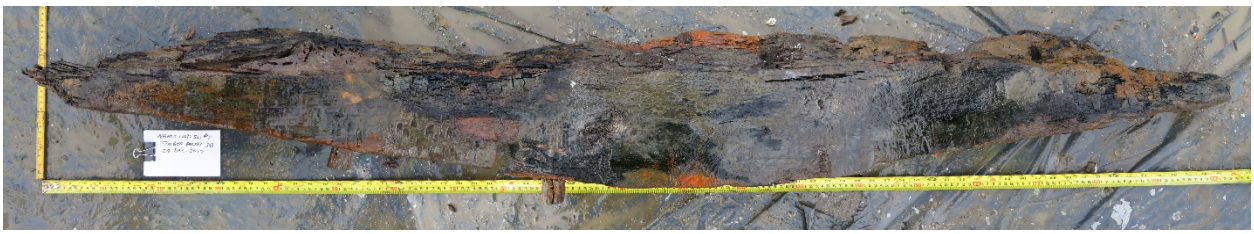
FLOOR D

FLOOR E

FLOOR E

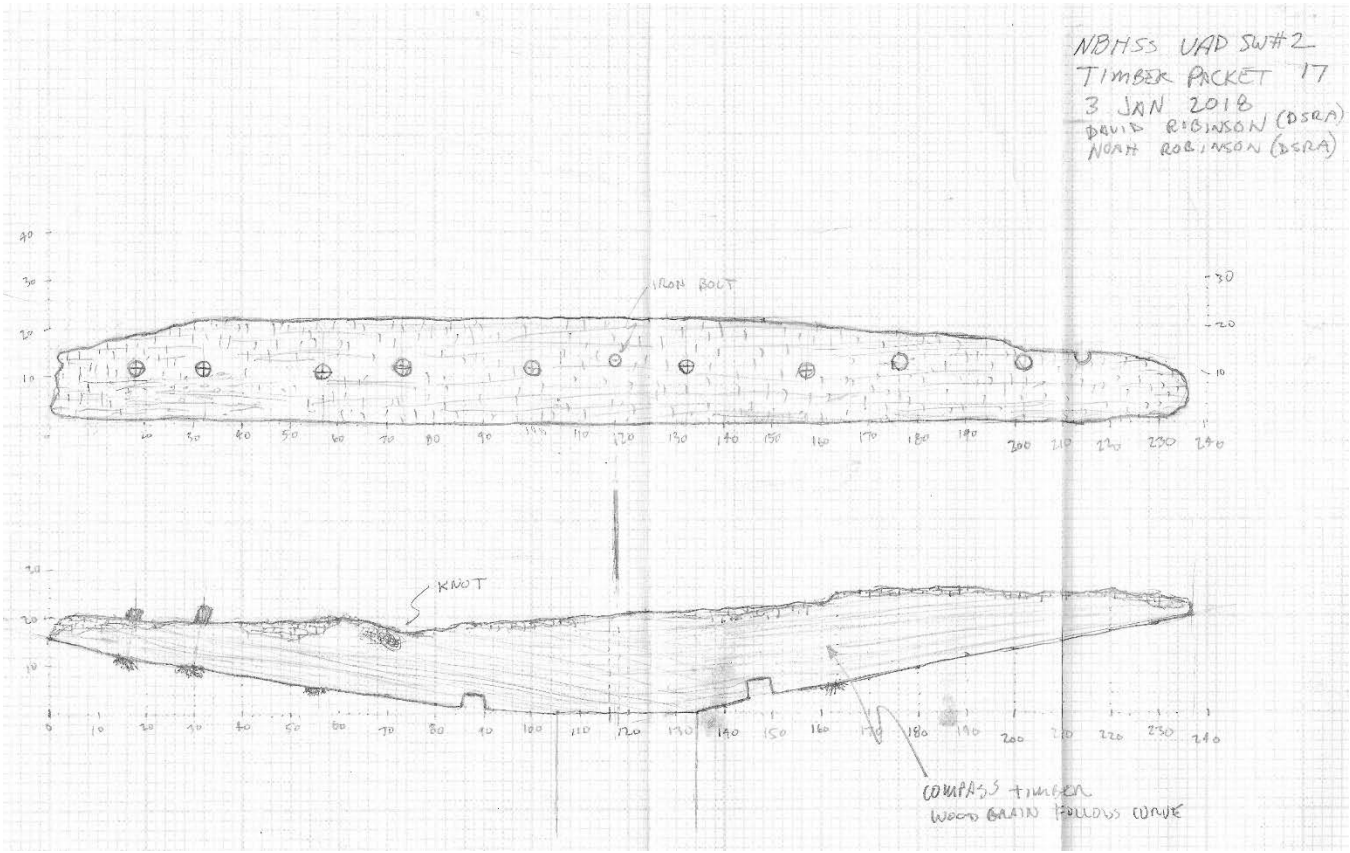

NBHSS UAD SW #2
TIMBER PACKET # 38
24 DEC 2017
DAVID ROBINSON (BSRA)
NOAH ROBINSON (BSRA)
WORM DAMAGE
CHAMFER
IRON BOLT
CHAMFER
WORM DAMAGE
WORM DAMAGE
CHAMFER SURFACE
PIT SAW MARKS
3cm DIAM
ADZE MARKS
PROTRUDES 4.5 cm
PROTRUDES 5cm
23 cm
ROUND IRON BOLT 2.5cm DIAM
3.5 x 6 cm

FLOOR E



FLOOR F

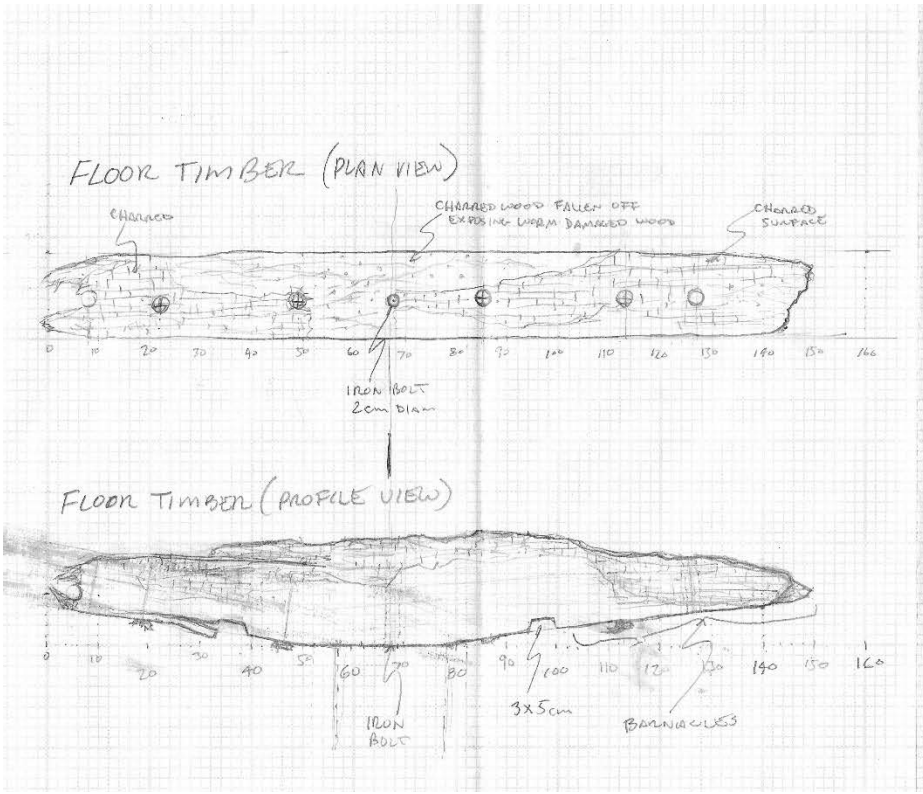
FLOOR F


NBHSS UAD SW#2
TIMBER PACKET 17
3 JAN 2018
DAVID ROBINSON (DSRA)
NOAH ROBINSON (DSRA)
IRON BOLT
KNOT
COMPASS TIMBER
WOOD GRAIN FOLLOWS CURVE

FLOOR F

FLOOR G

FLOOR G



NBASS UAD SW#2
TIMBER PACKET #34
24 DEC 2017
DAVID ROBINSON (DSRA)
NOAH ROBINSON (DSRA)

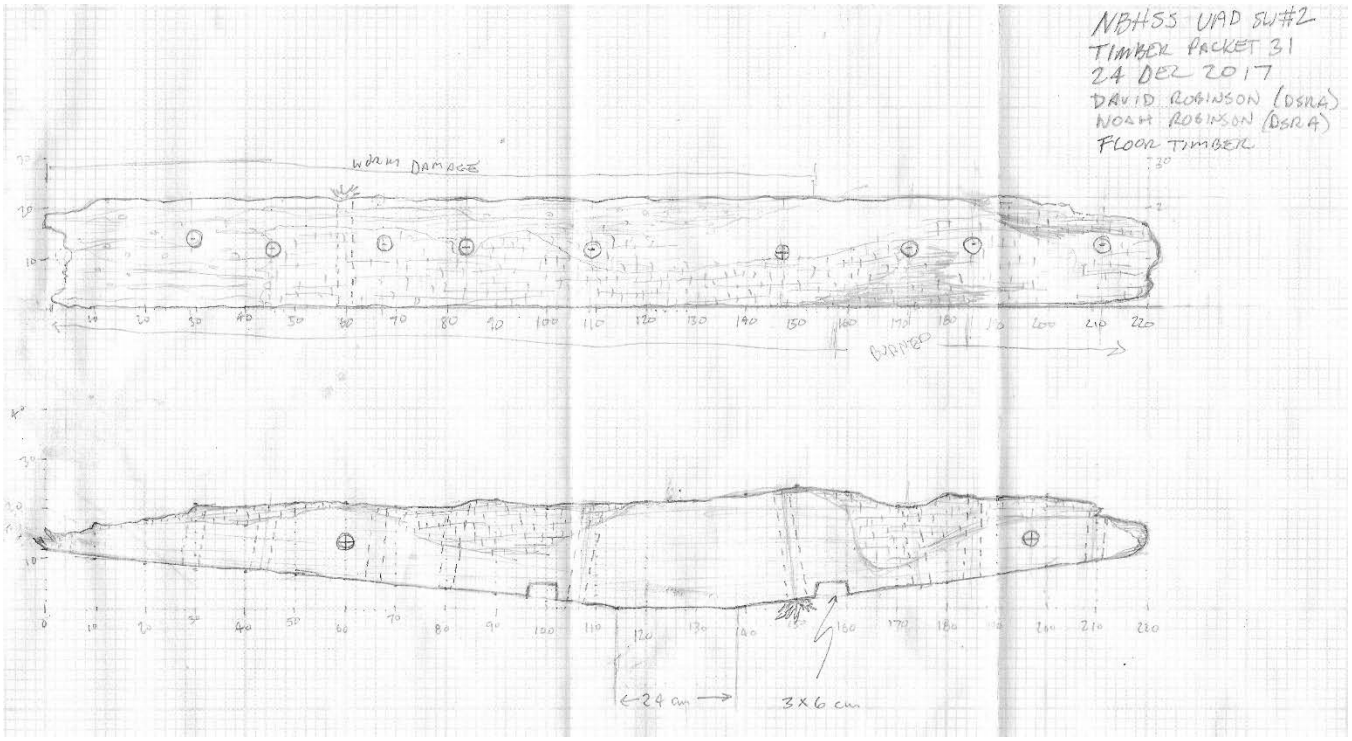
3 PIECES: (1) FLOOR
(1) FUTTOCK FRAGMENT

PHOTO'D ONLY - (1) PLANK FRAGMENT (BROKEN WIDTH)
4.5 cm THICK
38cm long x 8cm wide

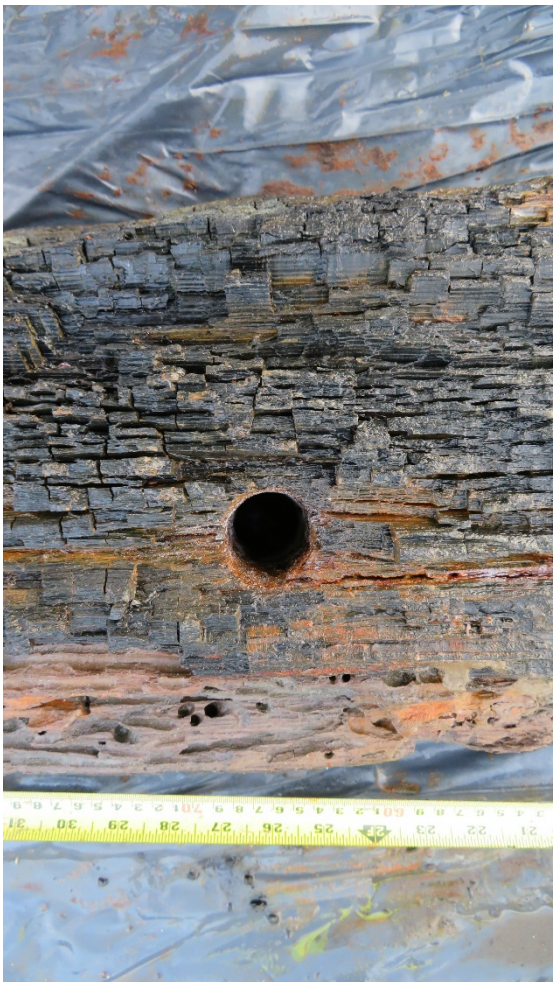
FLOOR G

FLOOR H

FLOOR H

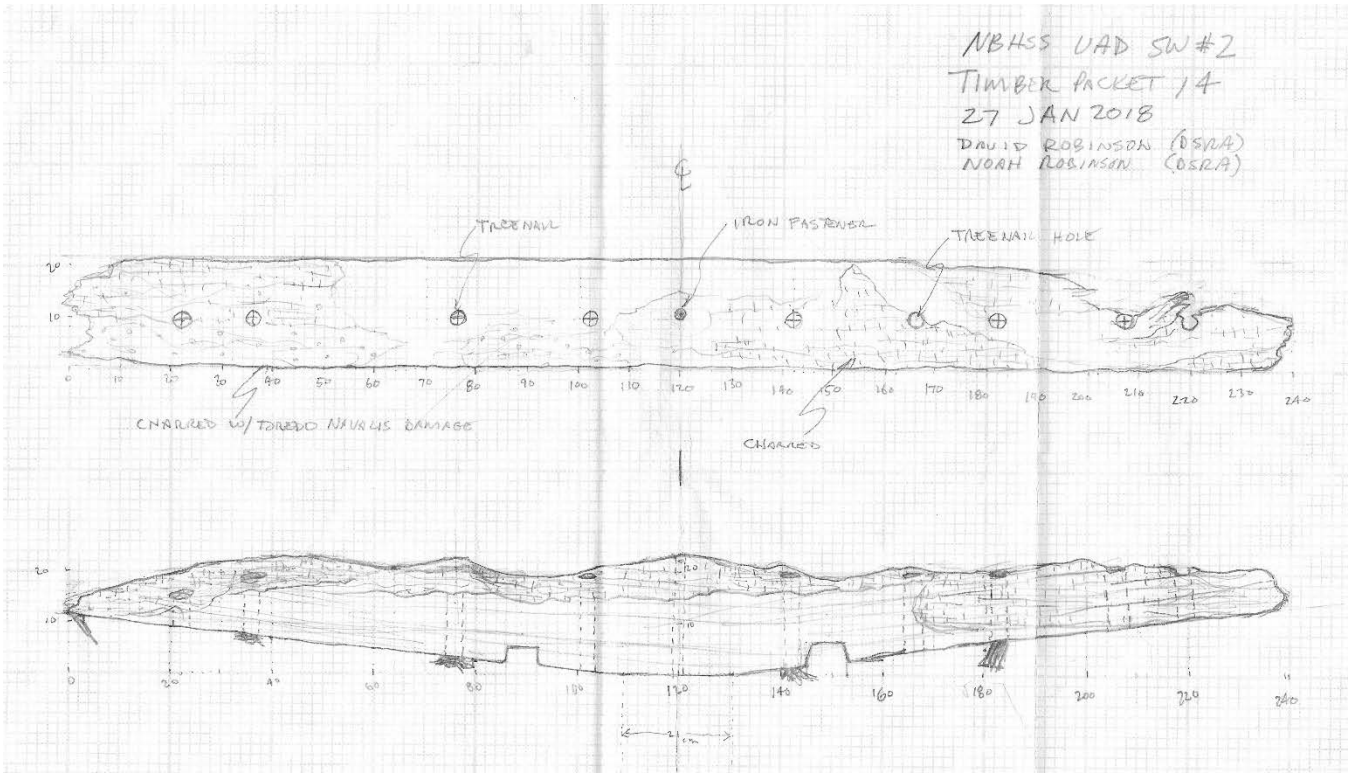

NBHSS UAD SW#2
TIMBER PACKET 31
24 DEC 2017
DAVID ROBINSON (DSRA)
NOAH ROBINSON (DSRA)
FLOOR TIMBER
WORM DAMAGE
BROKEN
←24 cm→
3X6 cm

FLOOR H



FLOOR I

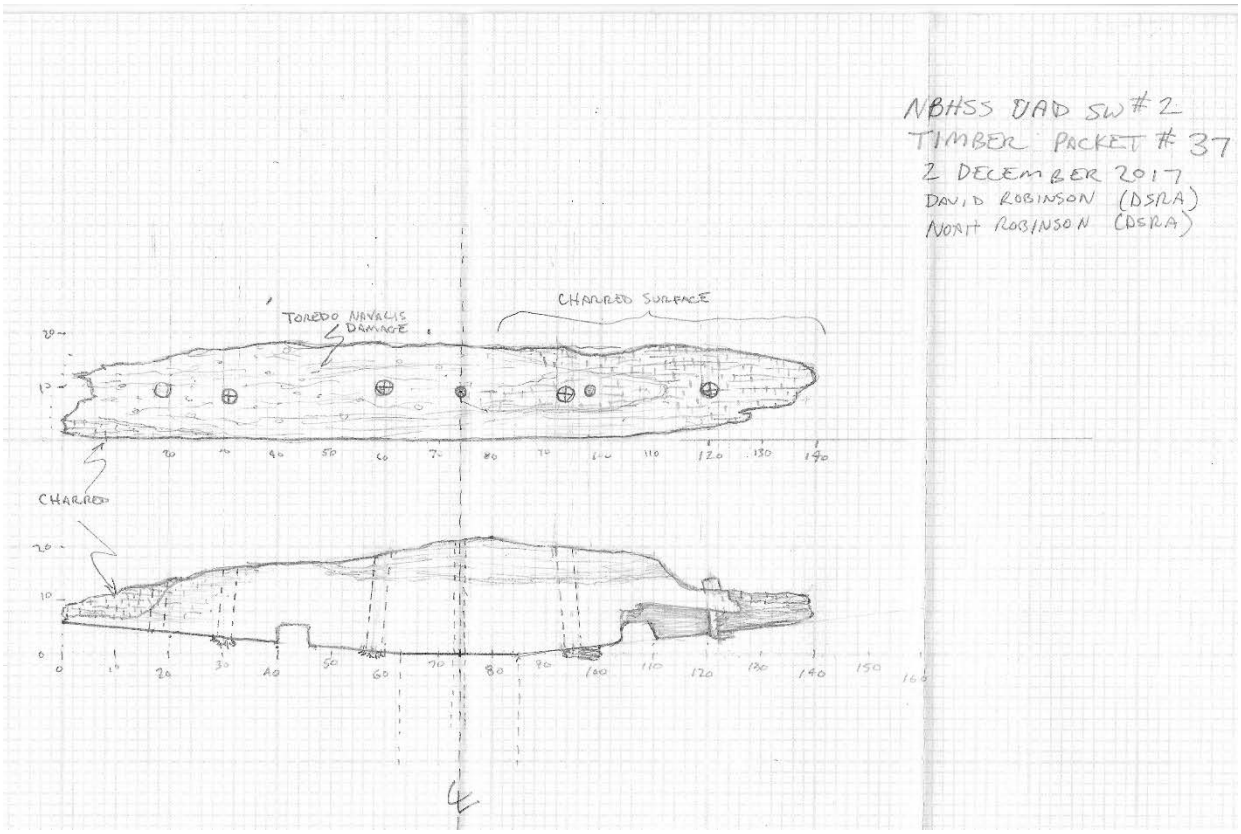
FLOOR I


NBHSS UAD SW #2
TIMBER PACKET 14
27 JAN 2018
DAVID ROBINSON (OSRA)
NOAH ROBINSON (OSRA)
TREENAIL
IRON FASTENER
TREENAIL HOLE
CHARRED W/ TORREDO NAVALIS DAMAGE
CHARRED

FLOOR I

FLOOR J

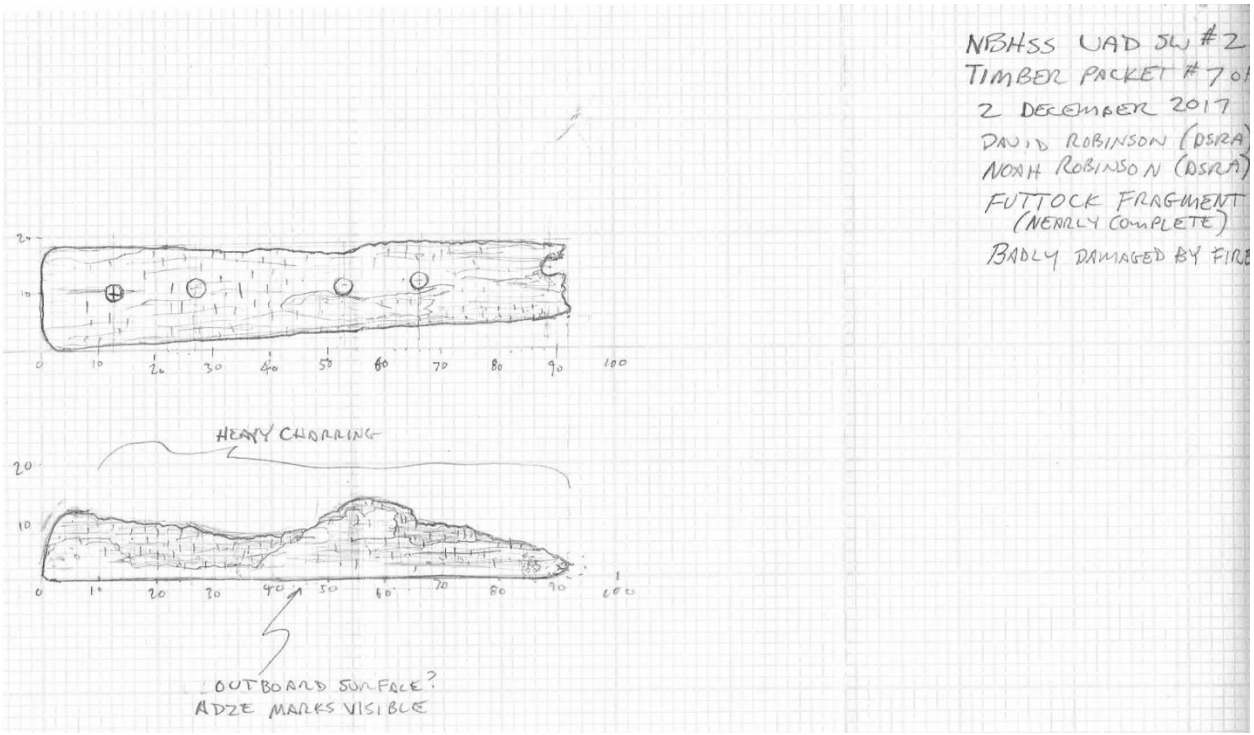
FLOOR J


NBHSS DAD SW#2
TIMBER PACKET #37
2 DECEMBER 2017
DAVID ROBINSON (DSRA)
NOAH ROBINSON (DSRA)
TOREDO NAVALIS DAMAGE
CHARRED SURFACE
CHARRED

FLOOR J

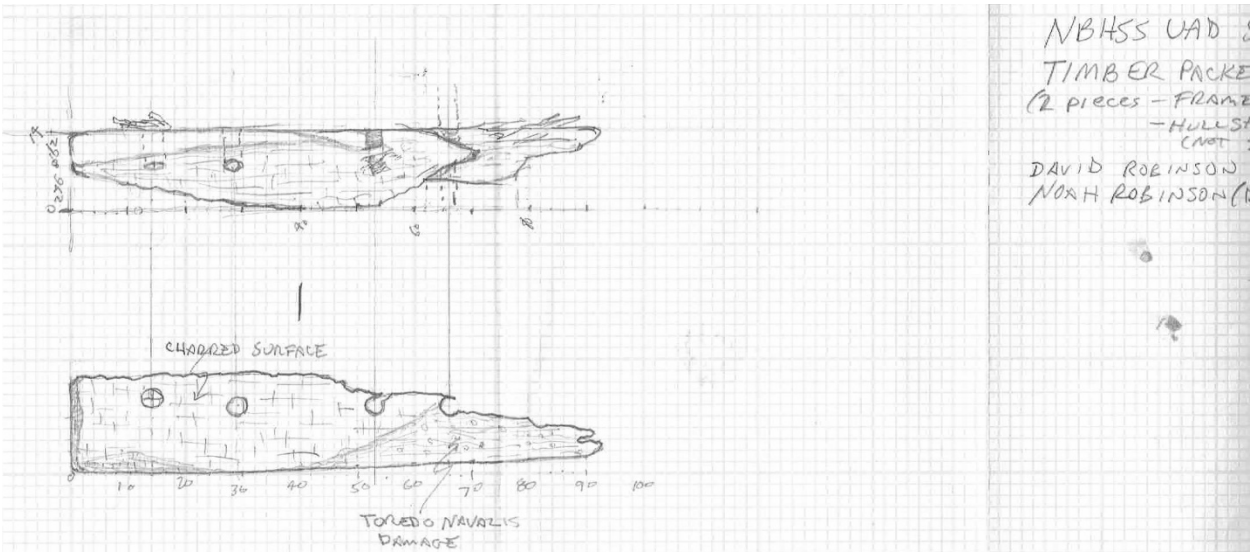
FUTTOCKS

FUTTOCKS
(FRAGMENT 1)

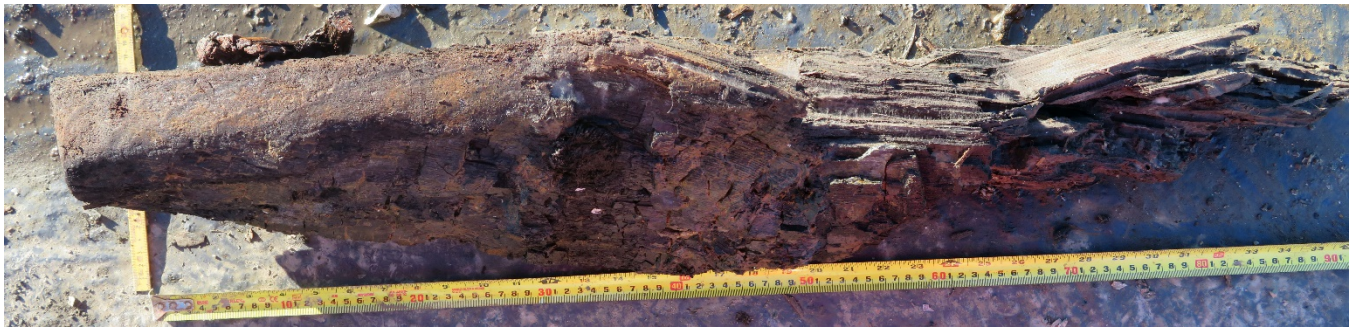


FUTTOCKS
(FRAGMENT 1)

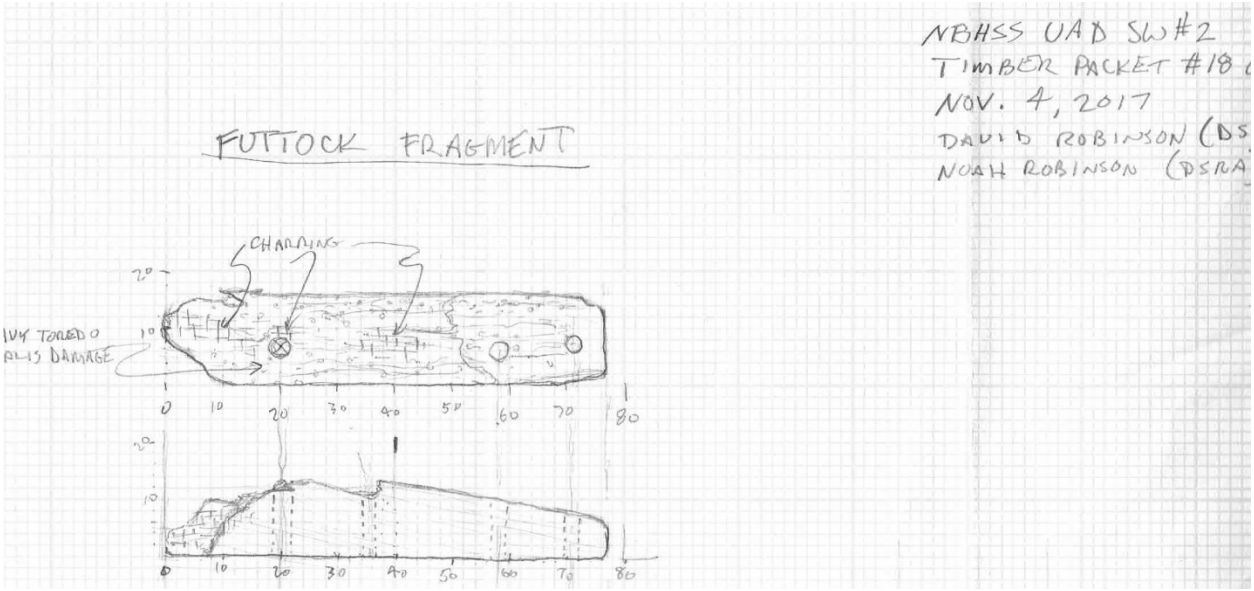
FUTTOCKS
(FRAGMENT 2)



FUTTOCKS
(FRAGMENT 2)

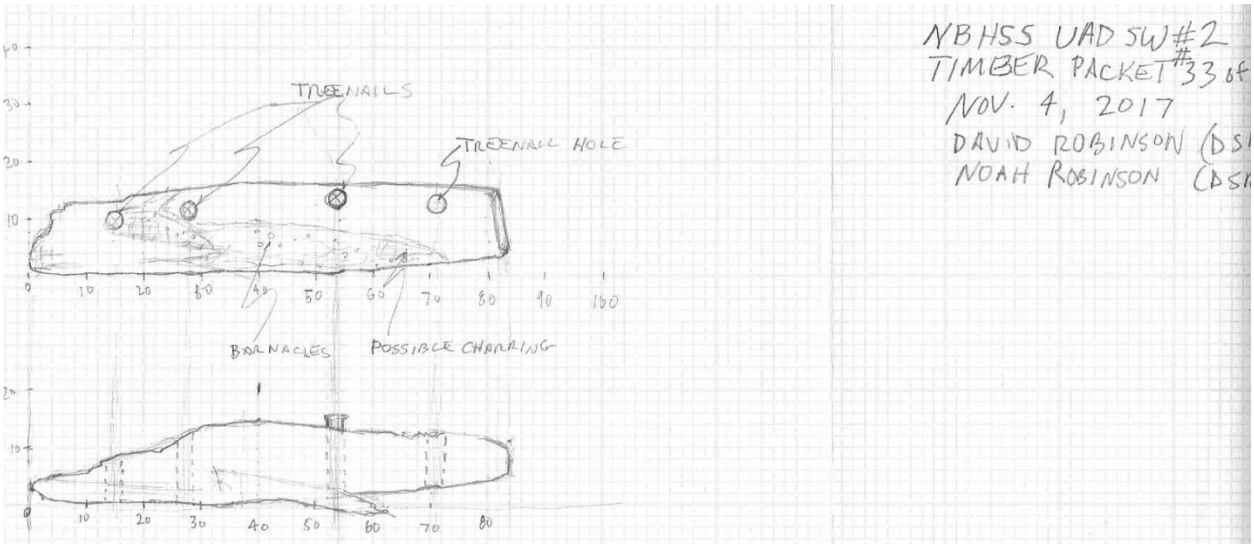


FUTTOCKS
(FRAGMENT 3)



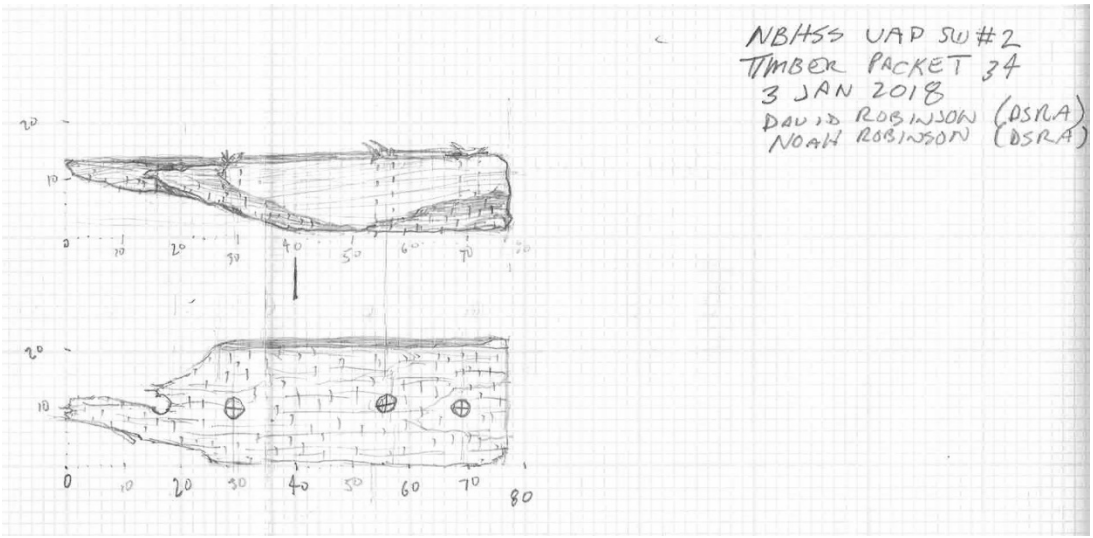
FUTTOCKS
(FRAGMENT 3)

FUTTOCKS
(FRAGMENT 4)



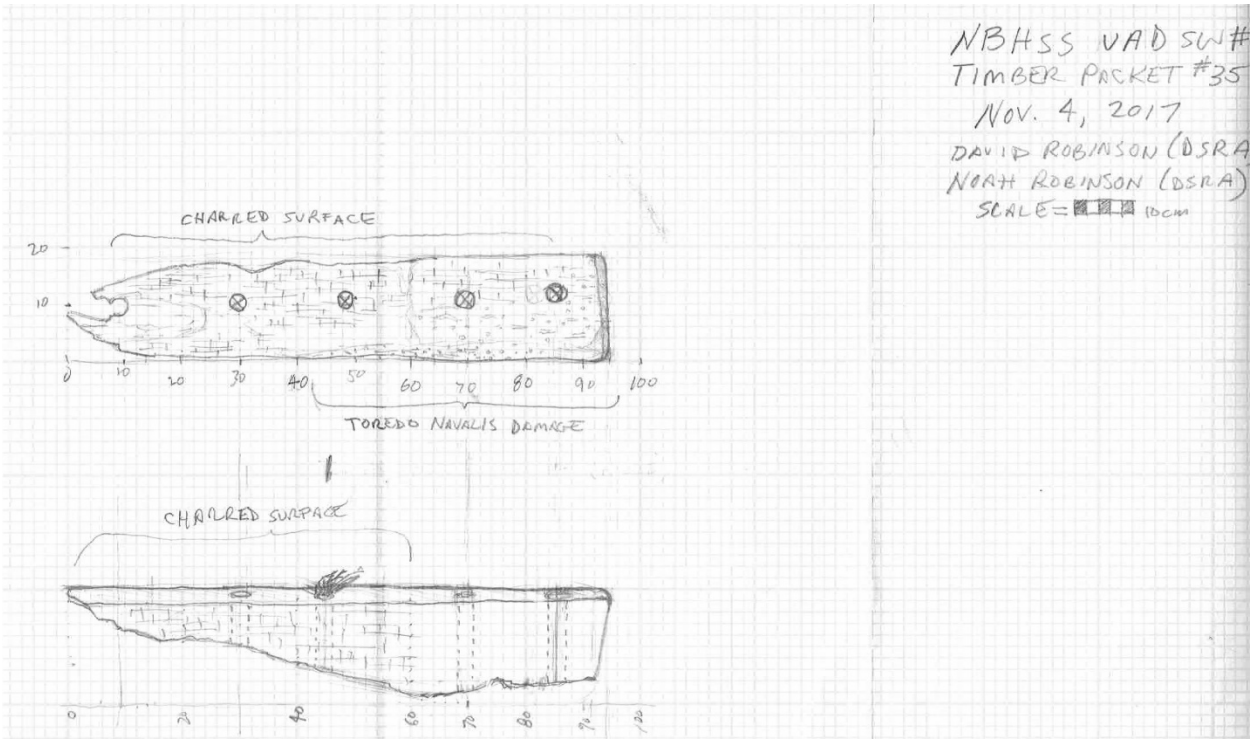
FUTTOCKS
(FRAGMENT 4)

FUTTOCKS
(FRAGMENT 5)



FUTTOCKS
(FRAGMENT 5)

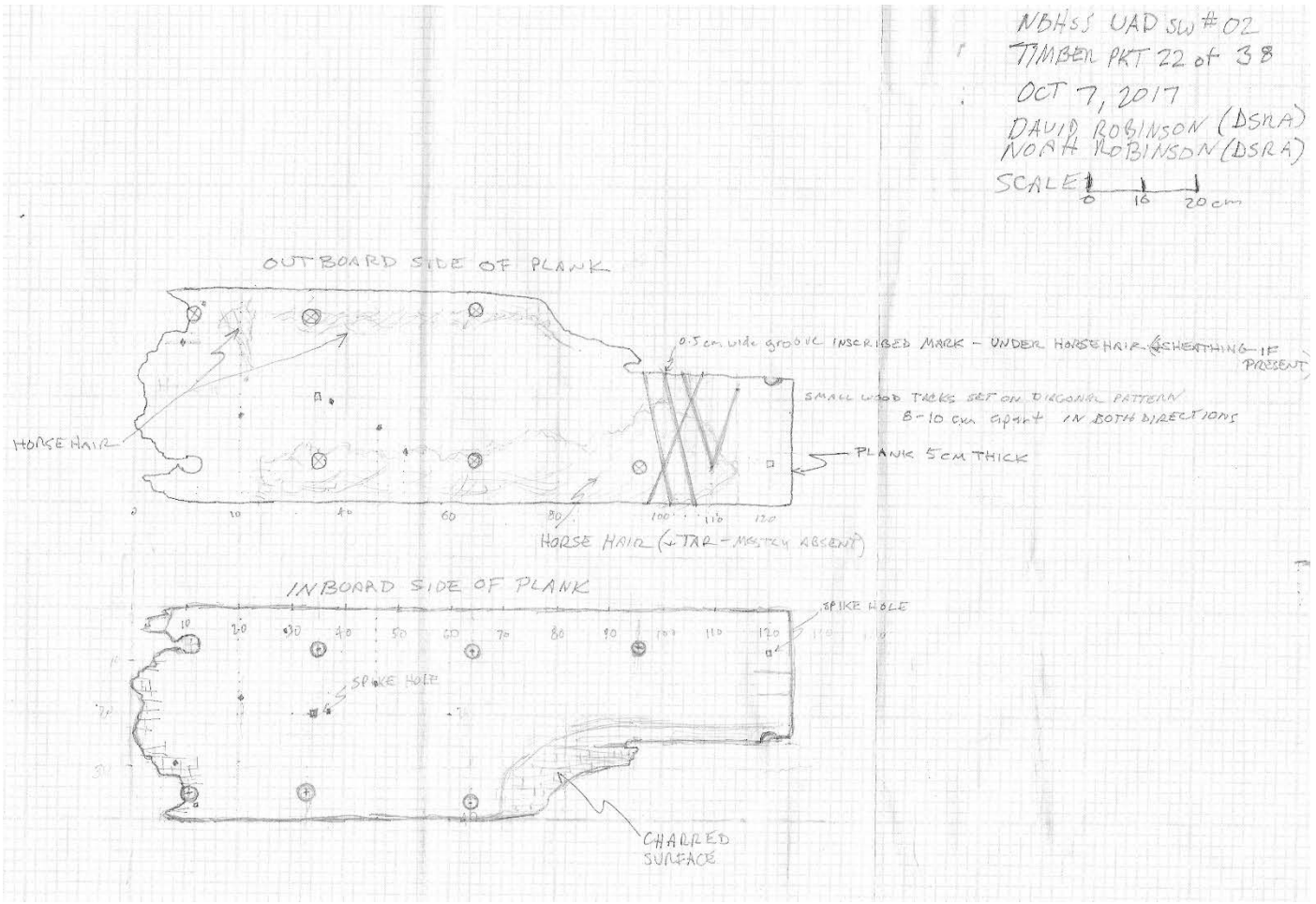
FUTTOCKS
(FRAGMENT 6)



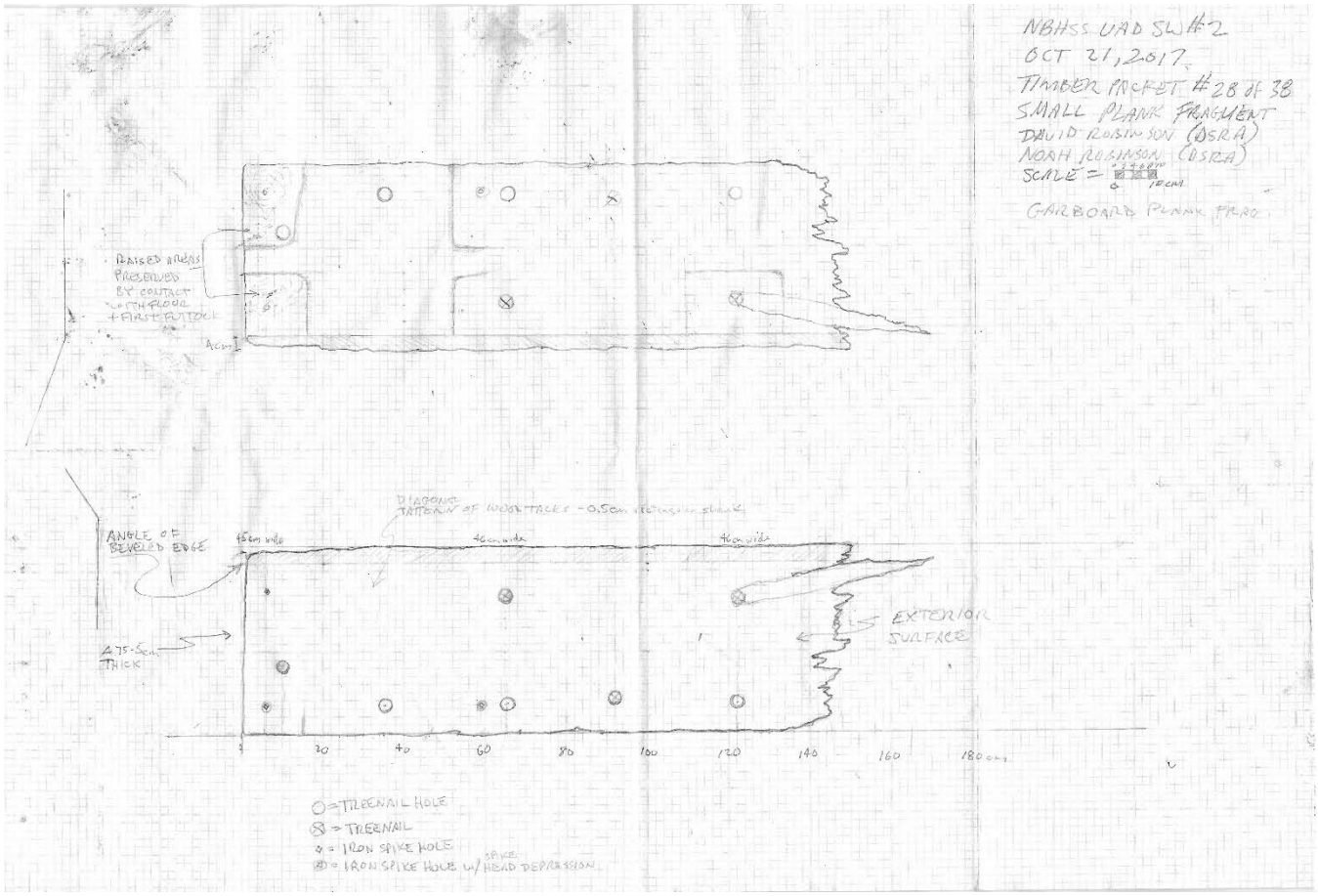
FUTTOCKS
(FRAGMENT 6)

PLANKING

PLANKING
(GARBOARD FRAGMENT 1)



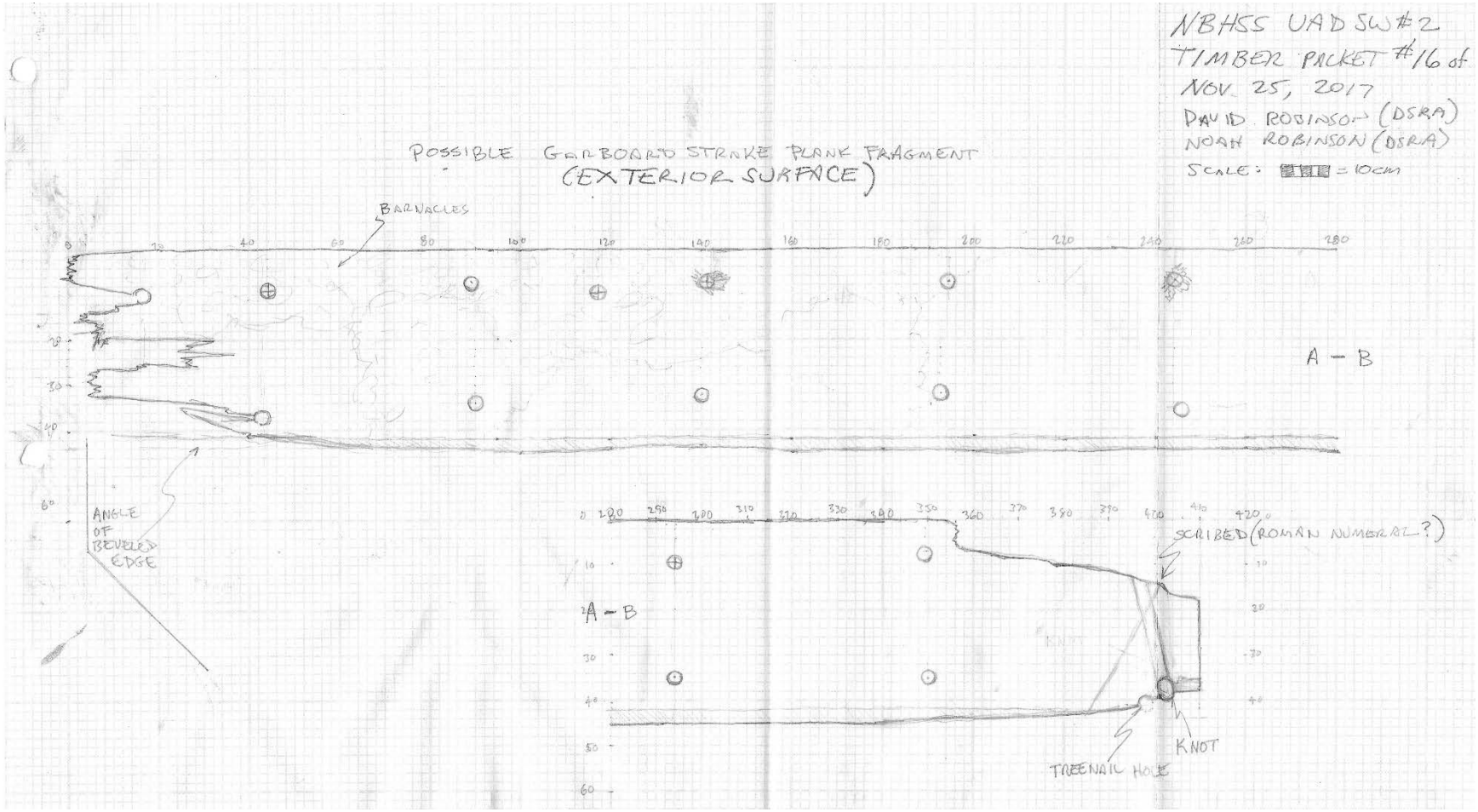
PLANKING
(GARBOARD FRAGMENT 2)



PLANKING
(GARBOARD FRAGMENT 2)

PLANKING
(GARBOARD FRAGMENT 3 – INBOARD FACE)

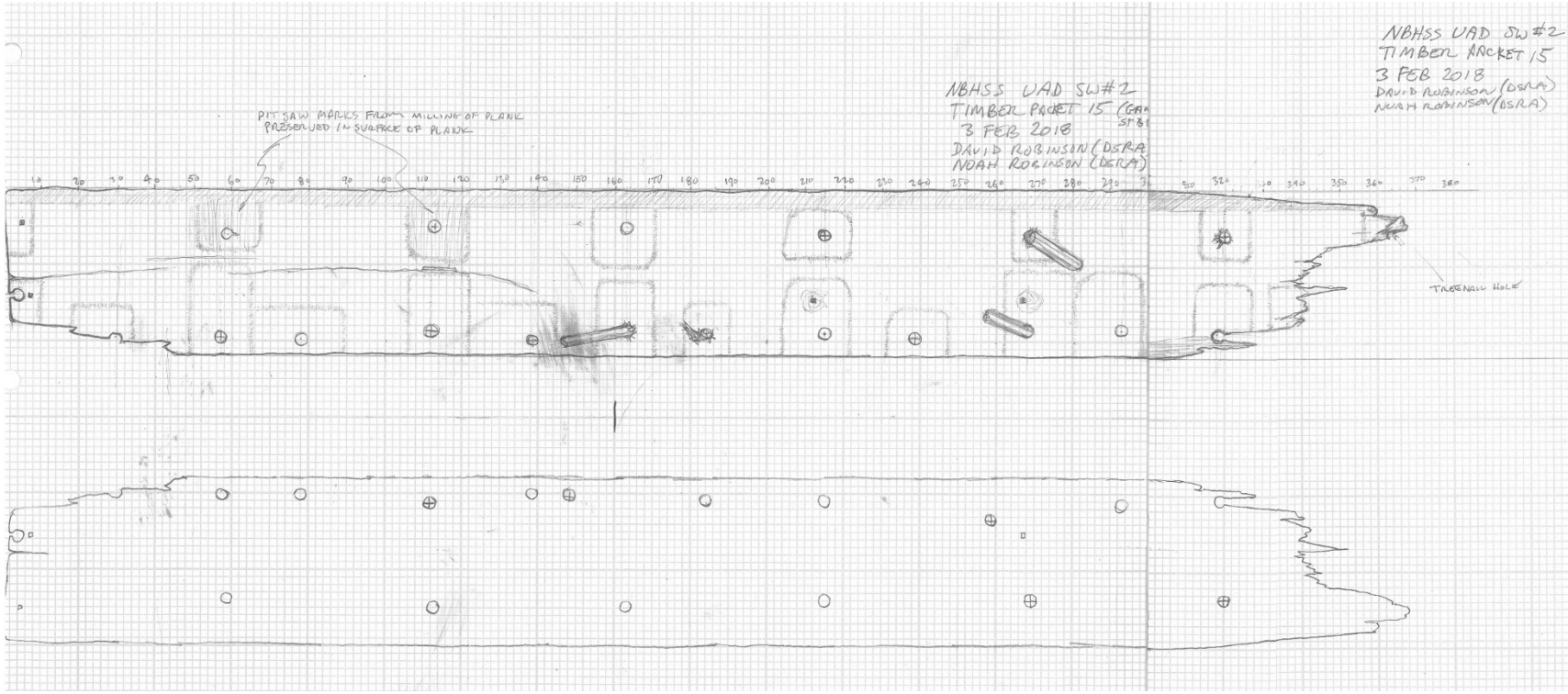
PLANKING
(GARBOARD FRAGMENT 3 – OUTBOARD FACE)



PLANKING
(GARBOARD FRAGMENT 3 – INBOARD FACE)

(GARBOARD FRAGMENT 3 – OUTBOARD FACE)

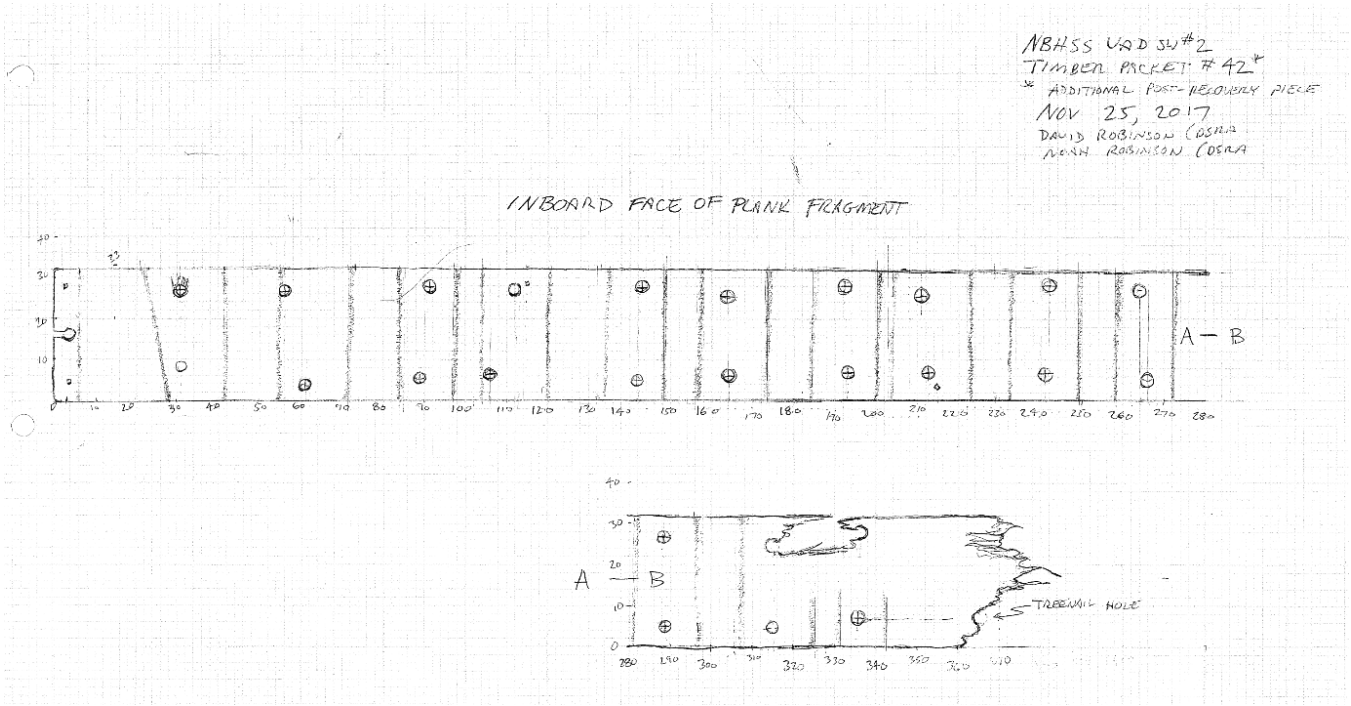
PLANKING
(GARBOARD FRAGMENT 4)



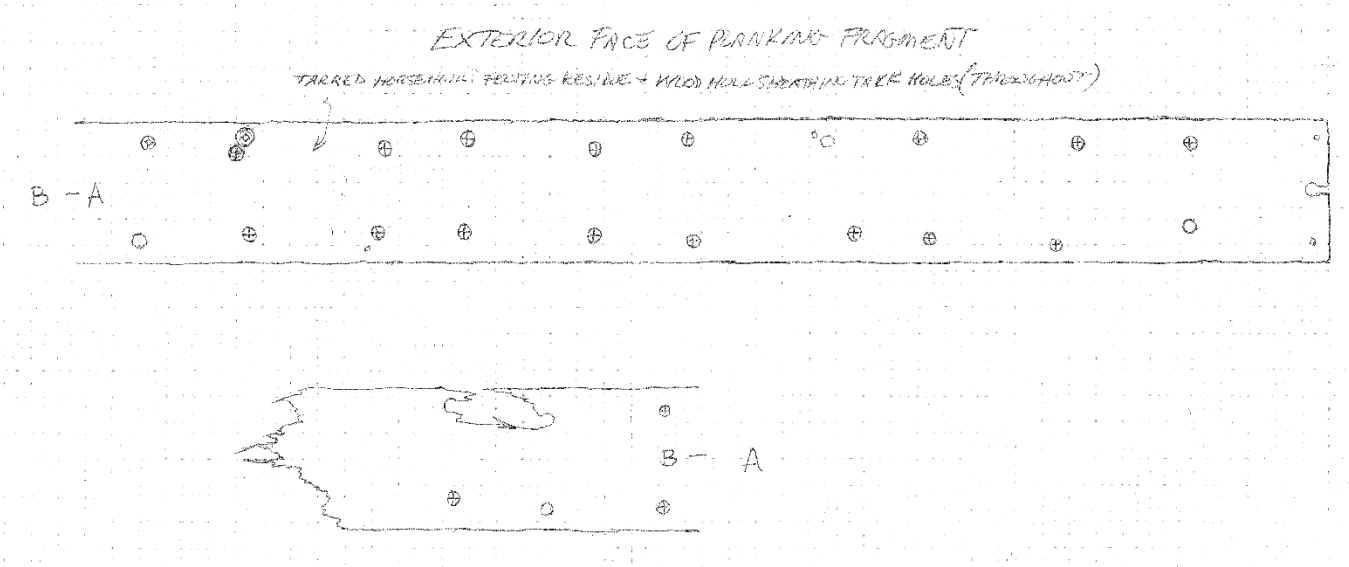
PLANKING
(GARBOARD FRAGMENT 4 – INBOARD FACE)

(GARBOARD FRAGMENT 4 – OUTBOARD FACE)

PLANKING
(HULL PLANKING – FIRST STRAKE – INBOARD FACE)



(HULL PLANKING – FIRST STRAKE – INBOARD FACE

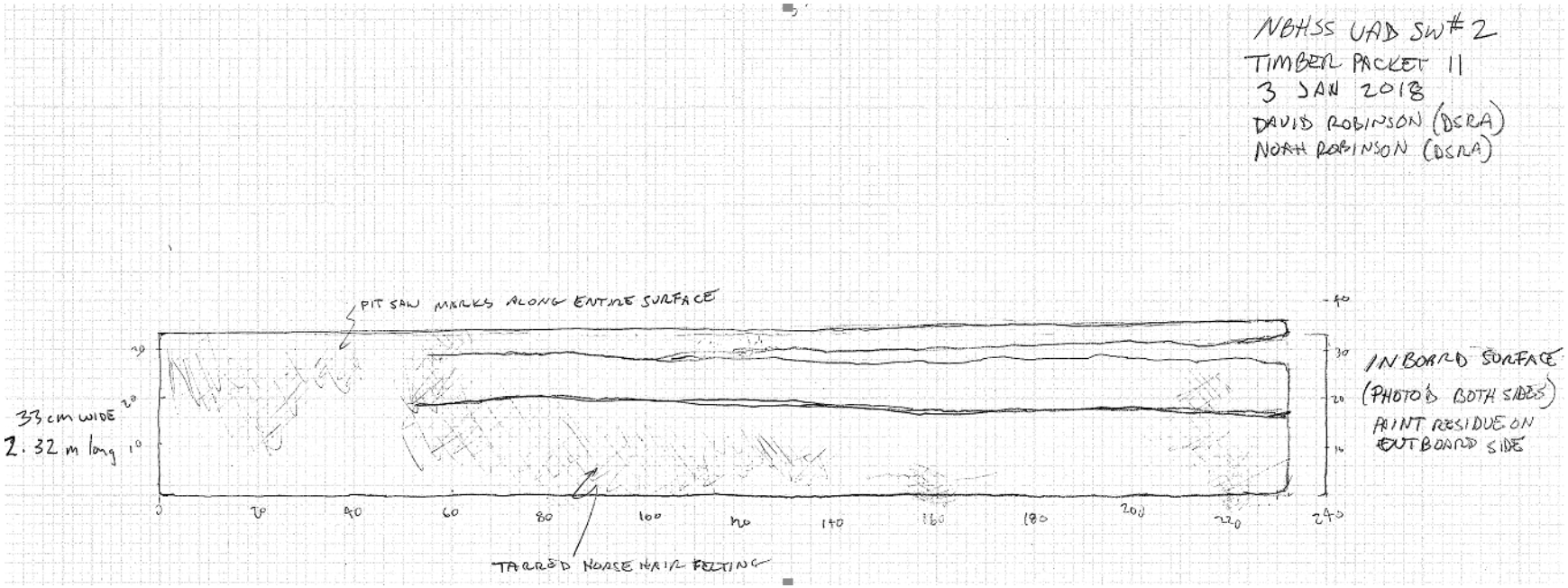


PLANKING
(HULL PLANKING – FIRST STRAKE – INBOARD FACE)

(HULL PLANKING – FIRST STRAKE – OUTBOARD FACE)

SHEATHING

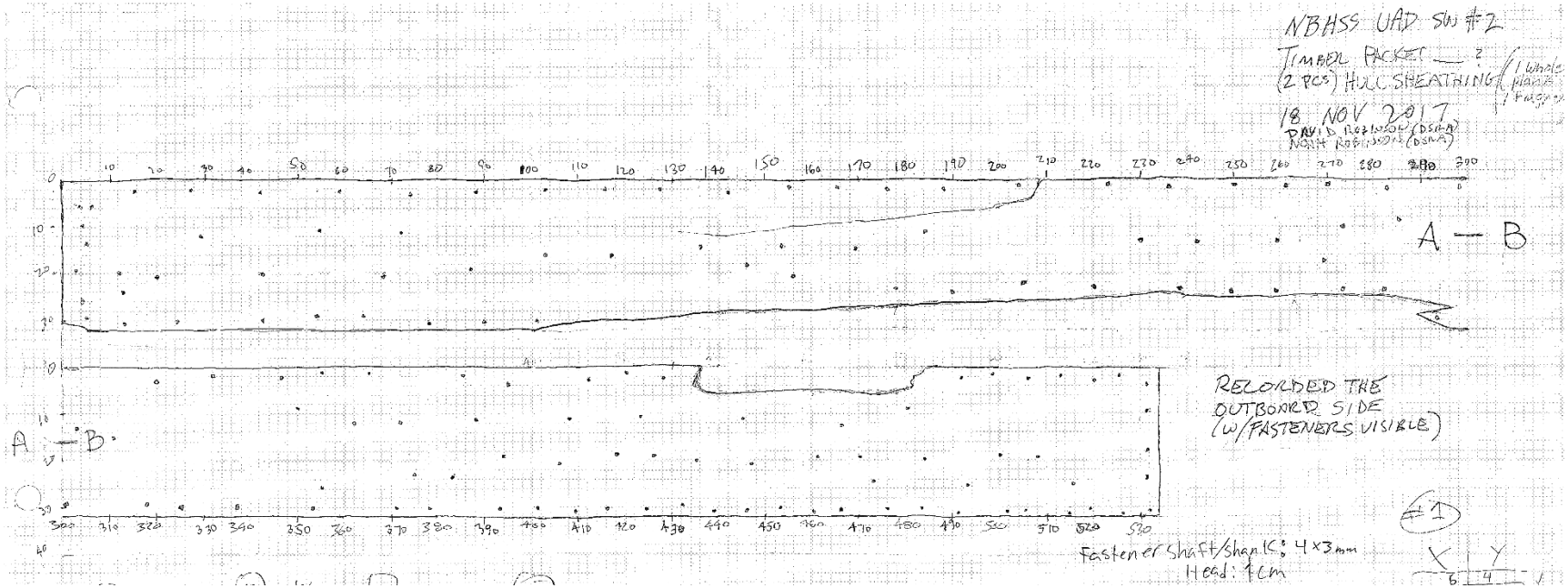
SHEATHING
(COMPLETE SHEATHING PLANK 1)



SHEATHING
(COMPLETE SHEATHING PLANK 1 – INBOARD SIDE)

SHEATHING
(COMPLETE SHEATHING PLANK 1 – OUTBOARD SIDE)

SHEATHING
(COMPLETE SHEATHING PLANK 2)



SHEATHING
(COMPLETE SHEATHING PLANK 2)

MISCELLANEOUS TIMBER

MISCELLANEOUS TIMBER

MISCELLANEOUS TIMBER