



# Preliminary Report of Saco River Submerged Debris Investigation

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**Disclaimer**

This report is preliminary, but data and information published herein are accurate to the best of our knowledge. Data synthesis, summaries and related conclusions may be subject to change as additional data are collected and evaluated. While the Maine Coastal Program makes every effort to provide useful and accurate information, investigations are site-specific and applicability of results to other regions in the state is not yet warranted. The Maine Coastal program does not endorse conclusions based on subsequent use of the data by individuals not under their employment. The Maine Coastal Program disclaims any liability, incurred as a consequence, directly or indirectly, resulting from the use and application of any of the data and reports produced by staff. Any use of trade names is for descriptive purposes only and does not imply endorsement by The State of Maine.

For an overview of the Maine Coastal Mapping Initiative (MCMI) information products, including maps, data, imagery, and reports visit <http://www.maine.gov/dacf/mcp/planning/mcmi/index.htm>.

## **Acknowledgements**

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## Introduction

In May of 2016 the Maine Coastal Mapping Initiative (MCMCI) conducted hydrographic surveying within the navigable waters of the Saco River between Camp Ellis and the Biddeford/Saco area located approximately 8 km (5 mi) upstream (Figure 1). Bathymetric (e.g. depth) and backscatter (e.g. seafloor substrate) data were collected using a multibeam echosounder (MBES). Preliminary analyses of these data provided the basis for a more specific investigation using underwater video recordings to help characterize the distribution and nature of submerged debris in the vicinity of a proposed dredging of the federal channel in the Biddeford/Saco portion of the Saco River. This investigation was performed at the request of the Maine Submerged Lands Program on behalf of the Cities of Saco and Biddeford, Maine. This project also coincides with state efforts to update coastal data sets and increase high resolution bathymetric coverage for Maine’s navigable waters and provides new data in the areas covered by National Oceanic and Atmospheric Administration (NOAA) nautical charts (e.g. coastal and harbor) 13286 and 13287 in southern Maine. These data were not collected or processed for specifically for navigational purposes, but are freely provided to NOAA for any use the agency deems appropriate.

The following report contains preliminary results related to the bathymetry and the characteristics and distribution of submerged debris that may pose hazards for mariners and/or future dredging operations in the vicinity of the Biddeford/Saco area of the Saco River in southern Maine (Figure 1). A full descriptive report related to MBES survey data acquisition and data post-processing for this investigation will be generated in the coming months.

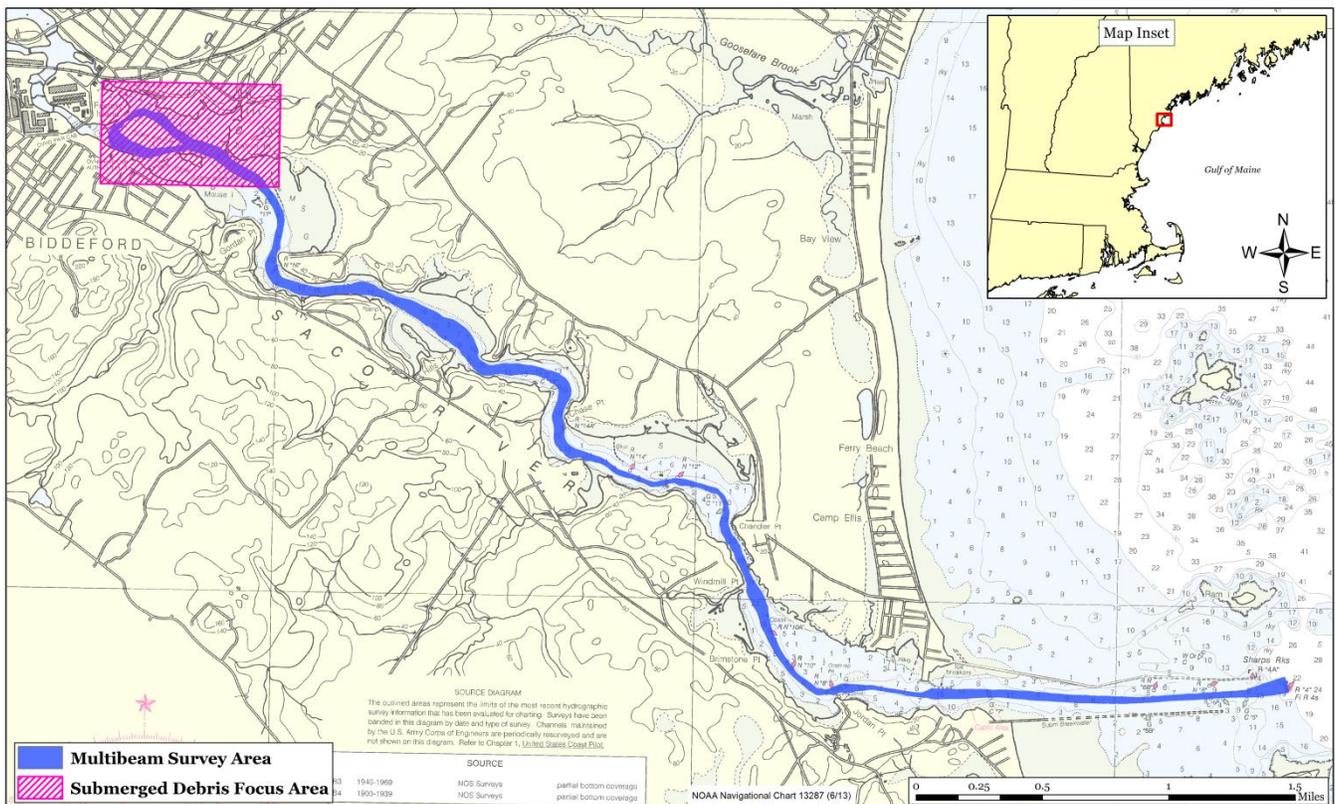


Figure 1. Overall multibeam survey coverage area in Saco River (blue polygon) and submerged debris focus area (patterned pink rectangle) in vicinity of Biddeford and Saco, ME.

## **Purpose**

This portion of this investigation was conducted to help characterize the distribution and nature of submerged debris as well as provide up-to-date, high-resolution bathymetry data in the vicinity of a proposed dredging area in the Biddeford/Saco portion of the Saco River. The results outlined in this report may facilitate further assessment of potential hazards posed by submerged debris and/or shallow portions of navigable waters within this portion of Saco River.

## **Focus Area**

The focus area was located in the navigable waters of the Saco River in the Biddeford/Saco area (Figure 1). This section of the Saco River is estuarine and has a mean tidal range of 2.76 m. A federal navigation channel extends to the head of tide below dams at Factory Island. It is within this upper reach of the estuary that shoaling occurs that requires periodic maintenance dredging by the U.S. Army Corps of Engineers in order to maintain safe navigation depths as authorized by Congress.

## **Methods**

A combination of data acquisition and processing techniques were employed to facilitate a high degree of confidence in the delineation of areas suspected to contain submerged debris. Bathymetric and backscatter data were collected using a MBES and provided the basis for this investigation. Based on a preliminary analysis of raw MBES data, specific sites containing the most prominent anomalies were selected for further investigations with an underwater video camera. Post-processing (e.g. data cleaning, incorporating tide data, etc.) and analysis of several forms of MBES data (e.g. bathymetry, backscatter, and pseudo-sidescan imagery) and subsequent review of video recordings were then used to delineate and characterize anomalies associated with suspected submerged debris. Summarized procedures for each portion of the investigation are provided in the following section. As mentioned previously, the following report contains preliminary results related to the characterization and distribution of submerged debris and potential hazards for mariners and/or future dredging operations in the vicinity of the Biddeford/Saco area of the Saco River in southern Maine. A full descriptive report for the hydrographic survey of the Saco River will be generated in the coming months.

### **Multibeam Echosounder Data Collection, Pre-processing and Video Target Selection**

All data were collected aboard the R/V Amy Gale (length = 10.7 m, width = 3.81 m, draft = 0.93 m), contracted to the MCMI. MBES data were collected using a pole-mounted Kongsberg EM2040c outfitted with a motion reference unit (MRU; used for real-time corrections of vessel motion in three dimensions), surface sound speed probe (used to monitor changes of sound velocity in the water column at the sonar head), and dual GNSS antennas for navigation and positioning. The main cabin of the vessel served as the data collection center and was outfitted with four display monitors for real time visualization of data during acquisition. The real time acquisition systems used aboard the R/V Amy Gale throughout the survey are outlined in Table 1 below. Data acquisition was performed using the Quality Positioning Services (QPS) QINSy (Quality Integrated Navigation System) acquisition software. The modules within QINSy integrated all systems and were used for real-time navigation, survey planning, data time tagging, data logging, and visualization during acquisition.

For most of the MBES survey, lines were not pre-planned but were run as a series of roughly parallel lines run along existing/known bathymetric contours. When possible, lines were spaced at consistent

intervals to obtain a minimum of 15% overlap between swaths. Surveying was conducted at approximately 4-5 knots but speed was reduced when necessary to avoid hazards or obstructions.

Table 1. Data acquisition hardware and software used aboard the R/V Amy Gale.

<b>Sub-system</b>	<b>Components</b>
Multibeam Sonar	Kongsberg EM2040C and processing unit
Position, Attitude, and Heading Sensor	Seapath 330 processing unit, HMI unit, dual GPS/GLONASS antennas, and MRU 5 motion reference unit
Data Acquisition and Display	QINSy software v.8.12 and 64-bit Windows 7 PC console
Surface Sound Velocity (SV) Probe	AML Micro X with SV Xchange
Sound Velocity Profiler (SVP)	Teledyne Odom Digibar S sound speed profiler
Ground-truthing Platform	Ponar grab sampler, GoPro Hero video camera, dive light, dive lasers

Frequent changes in sound speed throughout the water column in the surveyed area were expected due to the considerable freshwater input upstream and pronounced tidal exchange. Thus, sound velocity profiles were taken frequently throughout the survey to ensure accurate depth soundings were recorded.

During the acquisition process, raw sonar files were recorded (WGS84, UTM Zone 19N meters) and bathymetric and backscatter data were gridded at 0.5 m resolution, which enabled the real-time visualization of small-scale, low-relief features (e.g. bedforms, debris, etc.) on the river bottom. The locations of anomalous features (e.g. pronounced irregularities of suspected unnatural origin on the river bottom) were noted in real time for later review.

Once the MBES data acquisition process was complete the raw sonar files were imported in QPS' Qimera (v.1.2.4) software. A three-dimensional dynamic surface (0.5 m) was created for enhanced visualization of the river's bathymetry. The data were then inspected and cleaned using the 3-D Editor tool to remove of erroneous soundings. The cleaned data were then reviewed to visualize anomalous features suspected to contain submerged debris. The overall criteria utilized for interpreting the various types of survey data (in real time and in post-processing) for selecting anomalies as targets for further investigation relied on a combination of factors. These factors include the type of data being considered, survey conditions, the expected bottom types and features likely to be encountered (based on remote reconnaissance/existing charts and historical context of survey area), survey design parameters, local geology and geomorphology, and the scientific knowledge and practical experience of the surveyor/data

analyst. The locations of the most prominent anomalies of suspected unnatural origin were selected as targets for further investigation the following day using an underwater video camera rig.

### **Targeted Anomaly Video Investigation Procedure**

The objective of the video investigation was to obtain true imagery of anomalies suspected to contain submerged debris. These videos served the following purposes in this investigation: confirm the presence of submerged debris in targeted areas containing anomalies, infer and/or confirm the composition (e.g. wood, metal, etc.) of submerged debris, and correlate the physical attributes of anomalies with corresponding MBES data in their respective locations. These videos would ultimately be used to refine interpretations of additional anomalies identified in areas not included in the video investigation.

A total of 10 areas were selected for further investigation using the underwater video camera rig (Figure 2). These areas were chosen because they contained distinct anomalies in areas that presumably contained the highest likelihood of containing submerged debris. Specific areas presumed to contain submerged debris were based on pre-survey reconnaissance using existing maps, imagery, and historical context/activity in the vicinity of the focus area. Use of the underwater camera rig to visualize the selected targets involved one of two investigation techniques, a camera drop or a camera tow (Figure 2). The camera drop technique was selected for four isolated, discrete anomalies. This technique involved positioning the vessel in a manner which facilitated vertical deployment of the camera in a known position and orientation (e.g. camera bearing) on the river bed immediately adjacent to (and facing) the suspected anomaly. The coordinates and orientation of the rig were recorded in each location. Once on the river bed, the camera rig was allowed to record for several minutes to avoid poor video quality due to resuspension of sediment/induced turbidity. The camera tow technique was chosen for a total of six areas. One containing a relatively large, discrete anomaly and five larger areas containing multiple, poorly-defined anomalies and/or areas suspected to contain high densities of submerged debris. This technique involved slowly towing the camera rig (at an approximate idle speed of 3.5 kts), suspended slightly above or in contact with the river bed, along a pre-selected transect. When using this method the camera rig was lowered from the starboard (right) side of the vessel and towed with the camera oriented facing the stern of the vessel and parallel to the transect line. The orientation (bearing) of the camera and coordinates of the beginning and end of each transect were recorded. All videos were downloaded at the conclusion of the investigation for later review.

The video review process focused on the most prominent anomalies. Once an anomaly was visualized, a screengrab image was extracted from the video for illustration. A video time stamp and a brief description of zones suspected to contain submerged debris were recorded. The locations of prominent anomalies were georeferenced by synchronizing the video time stamp with the approximate position of the vessel at the time of visualization. The horizontal accuracy of coordinates reported for discrete anomalies identified in videos was approximately +/- 2 meters. The approximate coordinates of areas containing diffuse concentrations of suspected debris were noted as well. The coordinates of anomalies identified in videos were then plotted in a GIS with post-processed MBES data, which were used to further refine their respective locations.

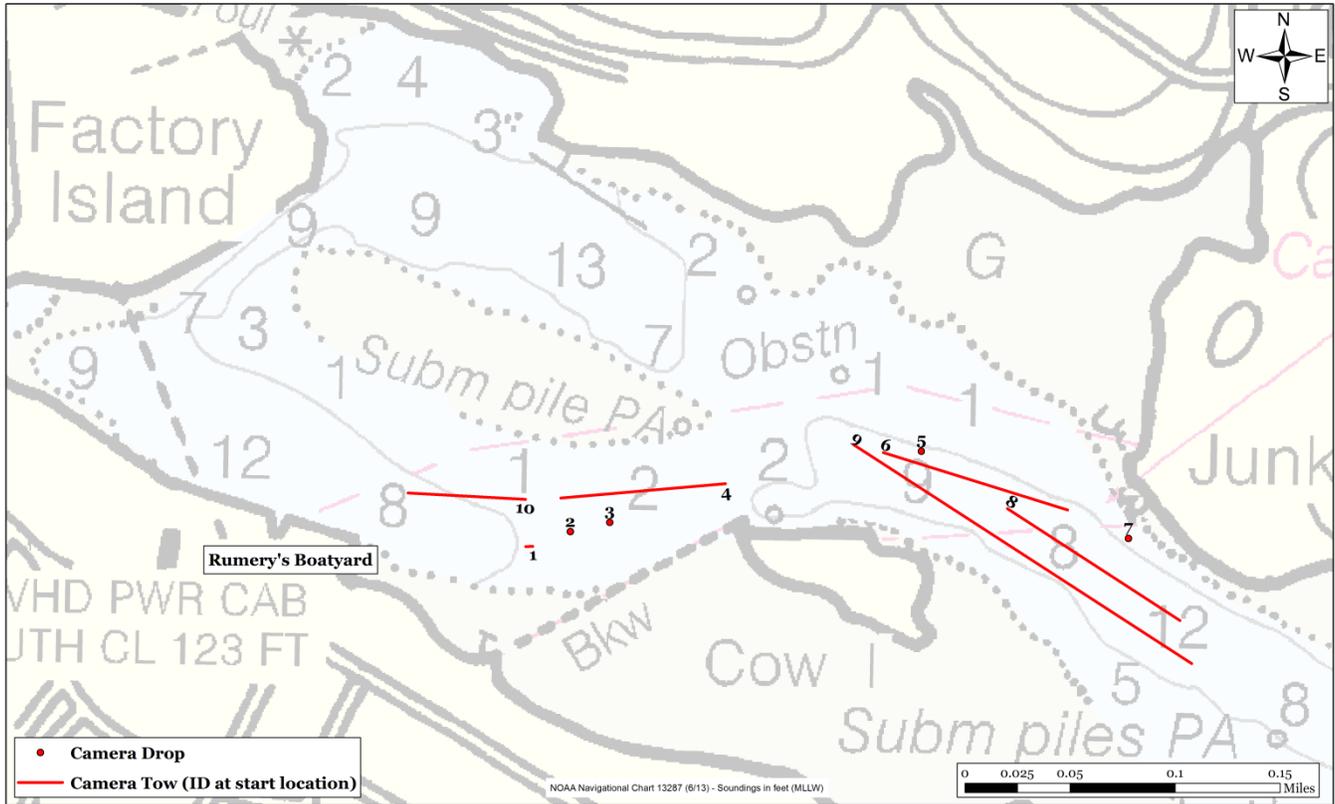


Figure 2. Map showing locations of camera drops (red circles) and camera tow transects (red lines). ID numbers for camera tows are located at the transect start location. NOAA nautical chart 13287 (updated 6/2013) in background contains soundings (depths) in feet referenced to mean lower low water level (MLLW).

**Multibeam Echosounder Data Post-processing and Delineation of Anomalies**

Following the conclusion of the survey and all video data collection the bathymetric and backscatter data were further processed and analyzed using Qimera, Fledermaus, Fledermaus Geocoding Tool (FMGT), and QINSy software to refine delineation of anomalies identified in the videos as well as delineate anomalies throughout the survey area. All data were collected and processed in WGS 84 projected in UTM zone 19N (meters).

The first step in the bathymetric data post-processing was to apply tide data to the raw sonar files used to create the initial dynamic surface (mentioned above). Predicted tide data (6-minute intervals) spanning the range of survey dates (May 19, 2016 – May 26, 2016) were downloaded from the NOAA Tides & Currents webpage for the Biddeford, Saco River, ME station (ID: 8418828) referenced to mean lower-low water (MLLW, meters) and integrated in to the surface created from the raw sonar files. The resulting bathymetric surface was deemed acceptable and contained minimal artifacts in the data (e.g. tide corrections errors that cause lineations with slight height offsets on overlapping swaths parallel to adjacent survey lines). The surface was then inspected once more to clean the data of erroneous soundings. Care was taken to avoid removing seemingly erroneous soundings that may have in fact represented real objects. Once the final surface bathymetric surface was created it was exported as a

surface object for visualization in Fledermaus and as a bathymetry attributed grid (.bag) file for visualization in a geographic information system (GIS). In addition, .gsf (general storage format) files containing the backscatter data were exported for mosaicking in FMGT.

Next, the raw sonar data collected in the focus area were replayed in QINSy (v.1.2.) and visualized using the Sidescan Viewer display module. This module allowed the replay and visualization of individual swaths of MBES data in a sidescan sonar format similar to traditional sidescan sonar imagery. During replay, the approximate footprint of anomalies were delineated and stored in a target database file. The target database containing a polygon of each anomaly footprint was then exported as a shapefile (.shp) for visualization in a GIS. In certain situations, the same anomaly was delineated on separate but overlapping swaths. Due to the possibility that a single swath may not have included the entire anomaly footprint, overlapping polygons in the output shapefile were merged and considered as a single anomaly (polygon).

Once all data was processed and visualized in a GIS, a final analysis was performed to further refine interpretations and distribution of suspected submerged debris in the focus area.

## **Results and Discussion**

The combination of video and MBES data analysis resulted in the delineation of 47 anomaly areas suspected or confirmed to contain submerged debris (Figure 3). These areas ranged in size from 1 m<sup>2</sup> to approximately 3150 m<sup>2</sup>, with a total combined area of 8146 m<sup>2</sup>. The footprints delineated for anomalies A04 and A05 fall within anomaly A35 and were subtracted from the total combined area. These anomalies (A04 and A05) were delineated separately from the surrounding zone because they represent key anomalies visualized in video recordings, served as calibration to improve interpretations of data, and/or may present a distinct hazard to those operating (e.g. dredging, mariners, recreational use) in their vicinity. The attributes (e.g. ID, footprint area, coordinates, and brief description) of anomalies shown in Figure 3 are located in Appendix A.

As an effort to guide any subsequent investigation of anomalies outlined in this report, each anomaly was given a value to correspond with a recommended investigation priority (RIP) (column X in Appendix A). A value of 1 indicates an area or discrete object with the highest investigation priority and a value of 3 represents the lowest priority. An anomaly with an RIP value of 1 had attributes consistent with one or several of the following criteria: (a) may pose an existing hazard to mariners due to size, depth, and proximity to surface during low tide, (b) may pose a hazard to those engaging in recreational activity (e.g. fishing, scuba diving, swimming), (c) may pose a hazard to dredging, or (d) has characteristics consistent with hazards shown on nautical charts (e.g. cable area). An anomaly with an RIP equal to 3 met one or several of the following criteria: (a) not suspected to present an immediate hazard to mariners, (b) suspected to be mostly comprised of coarse, woody debris, or (c) was not located in areas previously suspected to contain significant hazards. An RIP equal to 2 was chosen as an intermediate value for anomalies that did not fit neatly into either category. Using the RIP index for the 47 anomalies, 9 anomalies were assigned a value of 1, 7 anomalies a value of 2, and 31 anomalies a value of 3. It is important to note that the RIP index was developed as logistical aid for interpreting the findings included in this report and that all anomalies may present unique hazards to different types of activity within the Saco River. Thus, it is recommended that further investigation be performed in all anomaly locations to evaluate hazard potential.

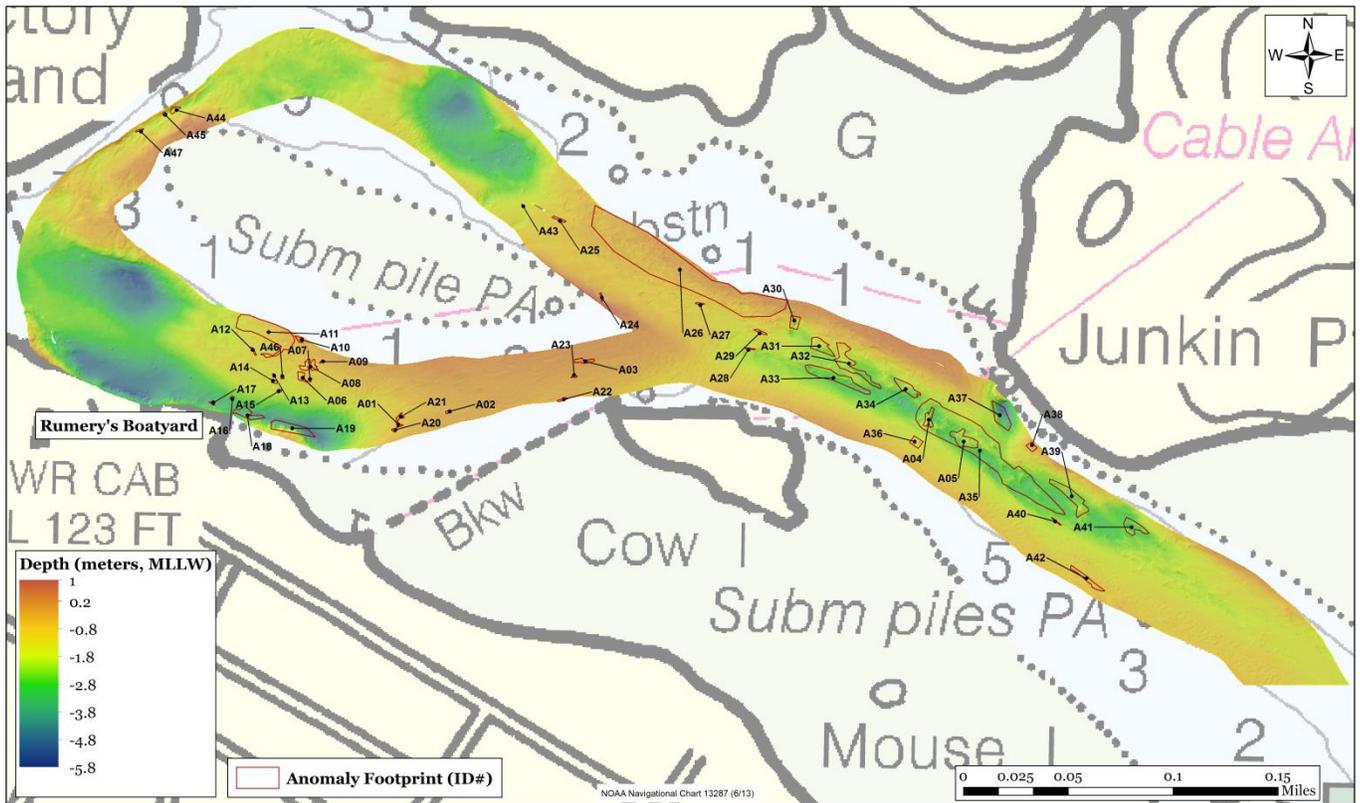


Figure 3. Bathymetric (MLLW, meters) and anomaly (outlined in red with corresponding ID) footprint map. See Appendix A for anomaly attributes.

Video recordings in 10 select areas (4 camera drops and 6 camera tows) confirmed the presence of submerged debris comprised of timber, metal, tires, and various forms of unknown composition. Although the presence of submerged debris was confirmed in these areas, it should be noted that the 47 anomalies delineated in this report represent the most distinct areas suspected to contain submerged debris and may not represent 100% of submerged debris actually present within the focus area outlined in this report. In addition, the largest anomaly polygons represent areas that contained multiple irregular-shaped or overlapping anomalies that could not be delineated as individual entities. Thus, the total areal footprint reported for some anomalies may be larger than the sum of the true footprint of smaller anomalies within these zones. Video logs, camera drop/tow coordinates, and notes recorded during the review process are presented in Appendix B.

Anomalies A01 through A06 were identified as those which best illustrate the range of submerged debris that was encountered in this investigation. Imagery and attributes of these anomalies, as well as select screengrabs from camera tows are included in Appendix C.

Depths in the focus area (Figure 3) ranged from +0.98 m to -5.78 m above and below MLLW, respectively. Positive values indicate areas that are normally exposed at low tide.

Raw sonar files and digital video files from camera drops/tows will be available upon request.

## **Conclusions**

In May of 2016 the Maine Coastal Mapping Initiative (MCMI) conducted hydrographic surveying within the navigable waters of the Saco River between Camp Ellis and the Biddeford/Saco area located approximately 8 km (5 mi) upstream (Figure 1). The portion of the investigation included in this preliminary report focused in the delineation and characterization of submerged debris in the Biddeford/Saco area. Analyses of bathymetric (e.g. depth) and backscatter (e.g. seafloor substrate) data and review of underwater video recordings confirmed the presence of submerged debris comprised of timber, metal, tires, and various forms of unknown composition. A total of 47 anomalies suspected or confirmed to contain submerged debris were delineated. These areas ranged in size from 1 m<sup>2</sup> to approximately 3150 m<sup>2</sup>, with a total combined area of 8146 m<sup>2</sup>. As an effort to guide any subsequent investigation of anomalies outlined in this report, each anomaly was given a value to correspond with a recommended (further) investigation priority (RIP) index. It is important to note that the RIP index was developed as logistical aid for interpreting the findings included in this report and that all anomalies may present unique hazards to different types of activity within the Saco River. Thus, it is recommended that further investigation be performed in all anomaly locations to evaluate hazard potential. In addition, special focus should be placed on the locations of anomalies (e.g. A04 and A35) that contain attributes consistent with known or suspected hazards (e.g. submerged metal cabling).

## **Appendix A - Anomaly Attribute Table**

<b>Anomaly ID</b>	<b>Area (m<sup>2</sup>)</b>	<b>Northing* (m)</b>	<b>Easting* (m)</b>	<b>Description</b>	<b>Recommended Investigation Priority (1=high 3=low)</b>
A01	5	4816416	383314	elongate/irregular, unknown composition, extends vertically from riverbed	1
A02	6	4816427	383352	polygonal, suspected woody debris	3
A03	38	4816466	383456	irregular, suspected woody debris	3
A04	64	4816422	383721	elongate/irregular, suspected coarse woody and unknown debris, partially buried, within footprint of A35	2
A05	163	4816405	383748	linear/irregular, suspected mass of metallic cables, partially buried and extending horizontally and vertically in water column, within footprint of A35	1
A06	33	4816454	383239	polygonal, suspected debris, extends vertically from riverbed, unknown composition	1
A07	2	4816451	383246	elliptical/round, suspected tire	3
A08	70	4816462	383245	elongate, suspected woody debris	3
A09	3	4816465	383254	elongate, suspected woody debris	3
A10	19	4816482	383238	irregular, assorted coarse debris	3
A11	594	4816488	383213	irregular, broad area containing assorted coarse debris	3
A12	7	4816473	383203	elongate, suspected woody debris	3
A13	1	4816456	383217	elliptical/round, suspected tire	3
A14	8	4816450	383218	elliptical/round, suspected tire	3
A15	4	4816443	383223	elliptical/round, suspected tire	3
A16	4	4816438	383186	polygonal/irregular, suspected debris, unknown composition	3
A17	4	4816433	383170	elongate/polygonal, suspected debris, unknown composition	3
A18	103	4816425	383197	linear/irregular, suspected debris, unknown composition	1
A19	200	4816414	383231	linear/irregular, suspected debris, unknown composition	1
A20	5	4816413	383310	elongate/polygonal, suspected debris, unknown composition	1
A21	14	4816422	383314	linear/irregular, suspected debris, unknown composition	3

A22	10	4816436	383439	elongate/polygonal, suspected debris, unknown composition	1
A23	6	4816454	383449	polygonal/irregular, suspected debris, unknown composition	3
A24	5	4816515	383469	linear, suspected debris, unknown composition	3
A25	15	4816574	383437	linear/elongate, suspected debris, partially buried, unknown composition	3
A26	3149	4816538	383527	irregular, broad area containing assorted coarse debris, suspected woody composition	3
A27	6	4816510	383545	elongate/polygonal, suspected debris, unknown composition	3
A28	7	4816475	383583	elongate/polygonal, suspected debris, unknown composition	3
A29	14	4816488	383592	elongate/irregular, suspected debris, unknown composition	3
A30	62	4816495	383618	irregular, suspected debris, unknown composition	3
A31	131	4816477	383638	multiple irregular and linear, suspected debris, unknown composition	2
A32	266	4816464	383661	multiple irregular and linear, suspected debris, unknown composition	2
A33	305	4816453	383649	irregular, suspected debris, unknown composition	3
A34	117	4816445	383704	multiple irregular and linear, suspected debris, unknown composition	3
A35	2207	4816398	383760	multiple irregular and linear, suspected debris, unknown composition	1
A36	52	4816404	383711	linear/irregular, suspected debris, unknown composition	3
A37	172	4816423	383776	linear/irregular, suspected debris, unknown composition	3
A38	32	4816400	383800	linear/arcuate, suspected debris, unknown composition	2
A39	223	4816361	383831	linear/irregular, suspected coarse woody debris	3
A40	7	4816342	383819	elongate/irregular, suspected debris, unknown composition	3
A41	126	4816338	383878	elongate/irregular, suspected coarse woody debris	3

A42	78	4816298	383842	multiple irregular and linear, suspected debris, unknown composition	3
A43	1	4816586	383409	polygonal, mooring block	3
A44	22	4816659	383142	elongate/irregular, suspected debris, unknown composition	1
A45	4	4816656	383134	elliptical/round, suspected tire	2
A46	3	4816453	383224	elliptical/round, suspected tire	2
A47	6	4816643	383115	linear/elongate, suspected debris, unknown composition	2

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\*Coordinates listed for centroid of each anomaly polygon (WGS84 UTM Zone 19N meters).

## **Appendix B - Saco River Camera Drop/Tow Video Logs**

Datum: WGS84 UTM Zone 19N meters

### Camera Drop/Tow 1

**Date:** 5/25/16

**Time (EST):** 10:23

**File name:** gopr0337.mp4

**Drop or tow:** drop/tow

**Tow direction/bearing:** 268° (E to W)

**Camera bearing (approximate):** 285° (start) – 360/0° (end)

**Tow start coordinates:** 383319 E 4816416 N

**Tow end coordinates:** 383313 E 4816416 N

**Associated raw sonar files:** 0052\_172255\_052416\_Saco\_River-0001.db, 0060\_180133\_052416\_Saco\_River-0001.db

**Associated Select Anomalies:** A1

**Video notes:** *Times shown (minutes:seconds:milliseconds) in the following notes denote time elapsed from start of recording. Green lasers in video are spaced 10cm apart for scale.*

00:00:00 – large, elongated object and adjacent large, irregular object that extend above seafloor; further investigation recommended

### Camera Drop 2

**Date:** 5/25/16

**Time (EST):** 10:52

**File name:** gopr0338.mp4

**Drop or tow:** drop

**Tow direction/bearing:** n/a

**Camera bearing (approximate):** 63°

**Drop coordinates:** 383347 E 4816427 N

**Associated raw sonar files:** 0052\_172255\_052416\_Saco\_River-0001.db, 0060\_180133\_052416\_Saco\_River-0001.db

**Associated Select Anomalies:** A2

**Video notes:** video shows suspected coarse, woody and metal debris

### Camera Drop 3

**Date:** 5/25/16

**Time (EST):** 11:10

**File name:** gopr0339.mp4

**Drop or tow:** drop

**Tow direction/bearing:** n/a

**Camera bearing (approximate):** 90°

**Drop coordinates:** 383377 E 4816434 N

**Associated raw sonar files:** 0052\_172255\_052416\_Saco\_River-0001.db, 0060\_180133\_052416\_Saco\_River-0001.db

**Associated Select Anomalies:** n/a

**Video notes:** suspected coarse woody debris

Camera Tow 4

**Date:** 5/25/16

**Time (EST):** 11:57

**File name:** gopr0341.mp4

**Drop or tow:** tow

**Tow direction/bearing:** 268° (east to west)

**Camera bearing (approximate):** 88°

**Tow start coordinates:** 383319 E 4816416 N

**Tow end coordinates:** 383313 E 4816416 N

**Associated raw sonar files:** 0049\_170035\_052416\_Saco\_River-0001, 0054\_173445\_052416\_Saco\_River-0001, 0056\_174635\_052416\_Saco\_River-0001.db, 0065\_181936\_052416\_Saco\_River-0001.db

**Associated Select Anomalies:** A3

**Video notes:** *Times shown (minutes:seconds:milliseconds) in the following notes denote time elapsed from start of recording. Green lasers in video are spaced 10cm apart for scale.*

01:33:02 – suspected large wooden planks

01:43:10 – suspected large wooden planks

02:10:40 to 02:15:21 – suspected large cylindrical wooden poles and coarse woody debris

02:49:26 – tire

02:52:15 to 02:57:39 – suspected large cylindrical wooden poles (telephone pole?)

02:36:49 – irregular structure/unknown/coarse debris

Camera Drop 5\*

\*site not investigated with camera due to proximity to channel buoy

**Date:** 5/25/16

**Time (EST):** 12:15

**File name:** n/a

**Drop or tow:** n/a

**Tow direction/bearing:** n/a

**Camera bearing (approximate):** n/a

**Coordinates:** 383616 E 4816489 N

**Associated raw sonar files:** 0043\_175440\_052416\_Saco\_River-0001.db, 0051\_171201\_052416\_Saco\_River-0001.db, 0053\_172824\_052416\_Saco\_River-0001.db, 0055\_174052\_052416\_Saco\_River-0001.db

**Associated Select Anomalies:** n/a

**Video notes:** n/a

Camera Tow 6

**Date:** 5/25/16

**Time (EST):** 12:27

**File name:** gopr0343.mp4

**Drop or tow:** tow

**Tow direction/bearing:** 107° (WNW to ESE)

**Camera bearing (approximate):** 287°

**Tow start coordinates:** 383587 E 4816488 N

**Tow end coordinates:** 383728 E 4816444 N

**Associated raw sonar files:** 0043\_175440\_052416\_Saco\_River-0001.db, 0043\_180152\_052416\_Saco\_River-0002.db, 0051\_171201\_052416\_Saco\_River-0001.db

**Associated Select Anomalies:** n/a

**Video notes:** *Times shown (minutes:seconds:milliseconds) in the following notes denote time elapsed from start of recording. Green lasers in video are spaced 10cm apart for scale.*

03:23:23 – suspected large cylindrical wooden poles (telephone pole?)

05:55:12 – suspected large cylindrical wooden poles (telephone pole?)

Most of video is very turbid and clarity is poor.

#### Camera Drop 7

**Date:** 5/25/16

**Time (EST):** 12:54

**File name:** gopr0344.mp4

**Drop or tow:** drop

**Tow direction/bearing:** n/a

**Camera bearing (approximate):** 307°

**Drop coordinates:** 383773 E 4816422 N

**Associated raw sonar files:** 0043\_175440\_052416\_Saco\_River-0001.db, 0051\_171201\_052416\_Saco\_River-0001.db, 0053\_172824\_052416\_Saco\_River-0001.db

**Associated Select Anomalies:** n/a

**Video notes:** *Green lasers in video are spaced 10cm apart for scale.*

Most of video is very turbid and clarity is poor.

#### Camera Tow 8

**Date:** 5/25/16

**Time (EST):** 13:04

**File name:** gopr0346.mp4

**Drop or tow:** tow

**Tow direction/bearing:** 123° (WNW to ESE)

**Camera bearing (approximate):** 303°

**Tow start coordinates:** 383682 E 4816445 N

**Tow end coordinates:** 383834 E 481644 N

**Associated raw sonar files:** 0046\_182243\_052316\_Saco\_River-0001.db, 0047\_183042\_052316\_Saco\_River-0001.db, 0048\_184011\_052316\_Saco\_River-0001.db

**Associated Select Anomalies:** A4 and A5

**Video notes:** *Times shown (minutes:seconds:milliseconds) in the following notes denote time elapsed from start of recording. Green lasers in video are spaced 10cm apart for scale but appear in frame intermittently.*

01:36:06 – tow motion begins

02:11:49 – coarse debris

02:18:14 to 02:21:24 – rectangular frame/ladder(?) of unknown composition partially embedded in river bed oriented roughly parallel to tow direction (approximate size: length 3-5 m, width 0.5 m)

02:50:38 to 03:08:43 – assorted coarse debris scattered and in irregular piles

03:10:48 to 03:20:08 – camera/rig frame makes contact with riverbed and submerged debris; suspected metal cable/wire (approximate diameter 2-4 cm, twisted/braided bundle of smaller strands) appears in frame, which is then followed by a large tangled mass of suspected cabling suspended horizontally and vertically above riverbed, approximate coordinates of object(s) between 383741 E 4816406 N and 383751 E 4816400 N; debris may extend to 03:30:00 in clip; further investigation recommended

04:04:00 to 04:19:00 suspected coarse woody debris and tires

### Camera Tow 9

**Date:** 5/25/16

**Time (EST):** 13:22

**File name:** gopr0347.mp4

**Drop or tow:** tow

**Tow direction/bearing:** 122° (WNW to ESE)

**Camera bearing (approximate):** 302°

**Tow start coordinates:** 383564 E 4816494 N

**Tow end coordinates:** 383823 E 4816326 N

**Associated raw sonar files:** 0044\_180537\_052316\_Saco\_River-0001.db, 0050\_170758\_052416\_Saco\_River-0001.db, 0060\_180133\_052416\_Saco\_River-0001.db

**Associated Select Anomalies:** n/a

**Video notes:** *Times shown (minutes:seconds:milliseconds) in the following notes denote time elapsed from start of recording. Green lasers in video are spaced 10cm apart for scale but appear in frame intermittently.*

01:18:00 to 01:25:00 – suspected coarse woody debris pile and tire

### Camera Tow 10

**Date:** 5/25/16

**Time (EST):** 13:41

**File name:** gopr0348.mp4

**Drop or tow:** tow

**Tow direction/bearing:** 273° (E to W)

**Camera bearing (approximate):** 93°

**Tow start coordinates:** 383313 E 4816452 N

**Tow end coordinates:** 383223 E 4816457 N

**Associated raw sonar files:** 0054\_173445\_052416\_Saco\_River-0001.db, 0056\_174635\_052416\_Saco\_River-0001.db, 0065\_181936\_052416\_Saco\_River-0001.db, 0066\_182507\_052416\_Saco\_River-0001.db

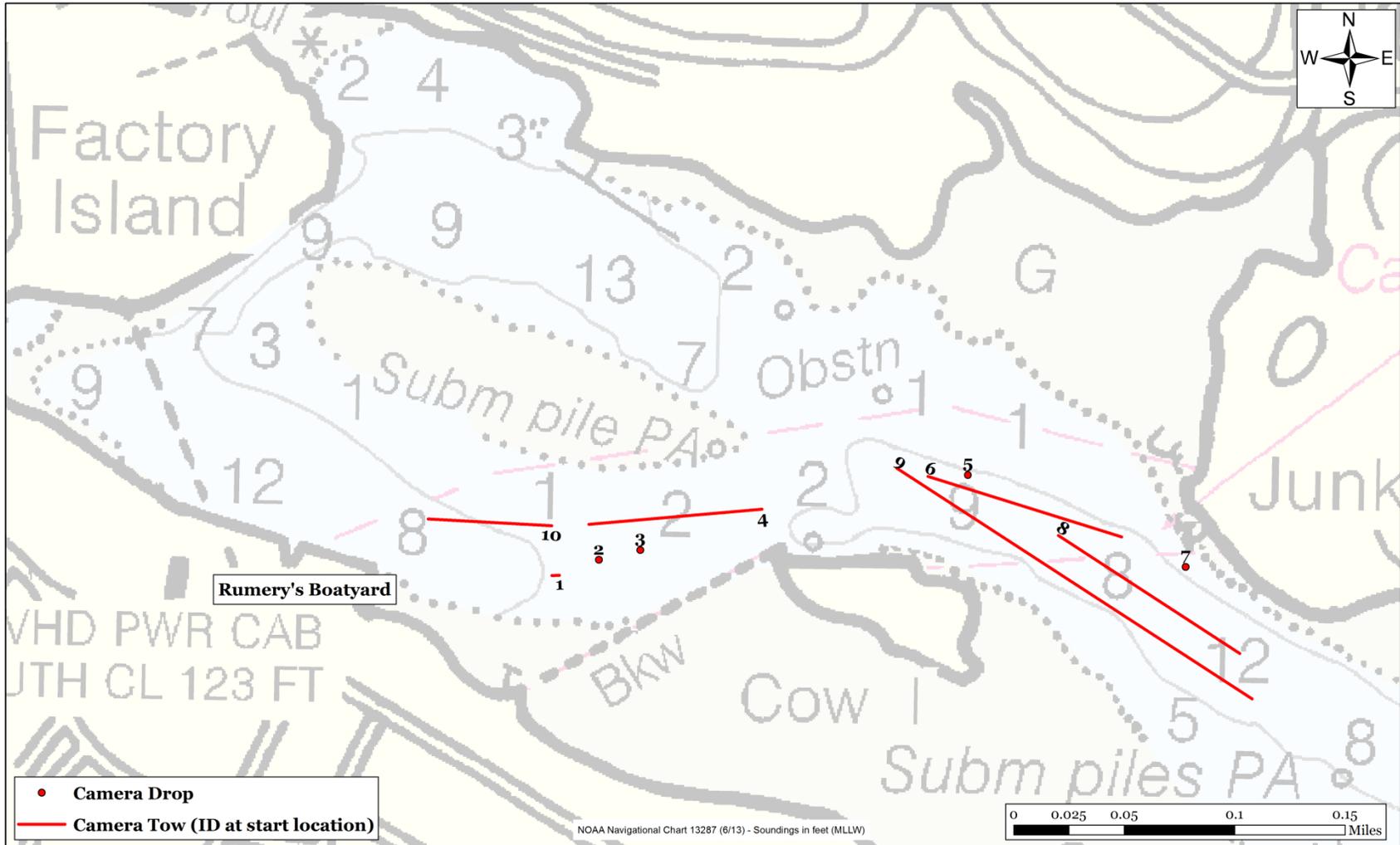
**Associated Select Anomalies:** A6

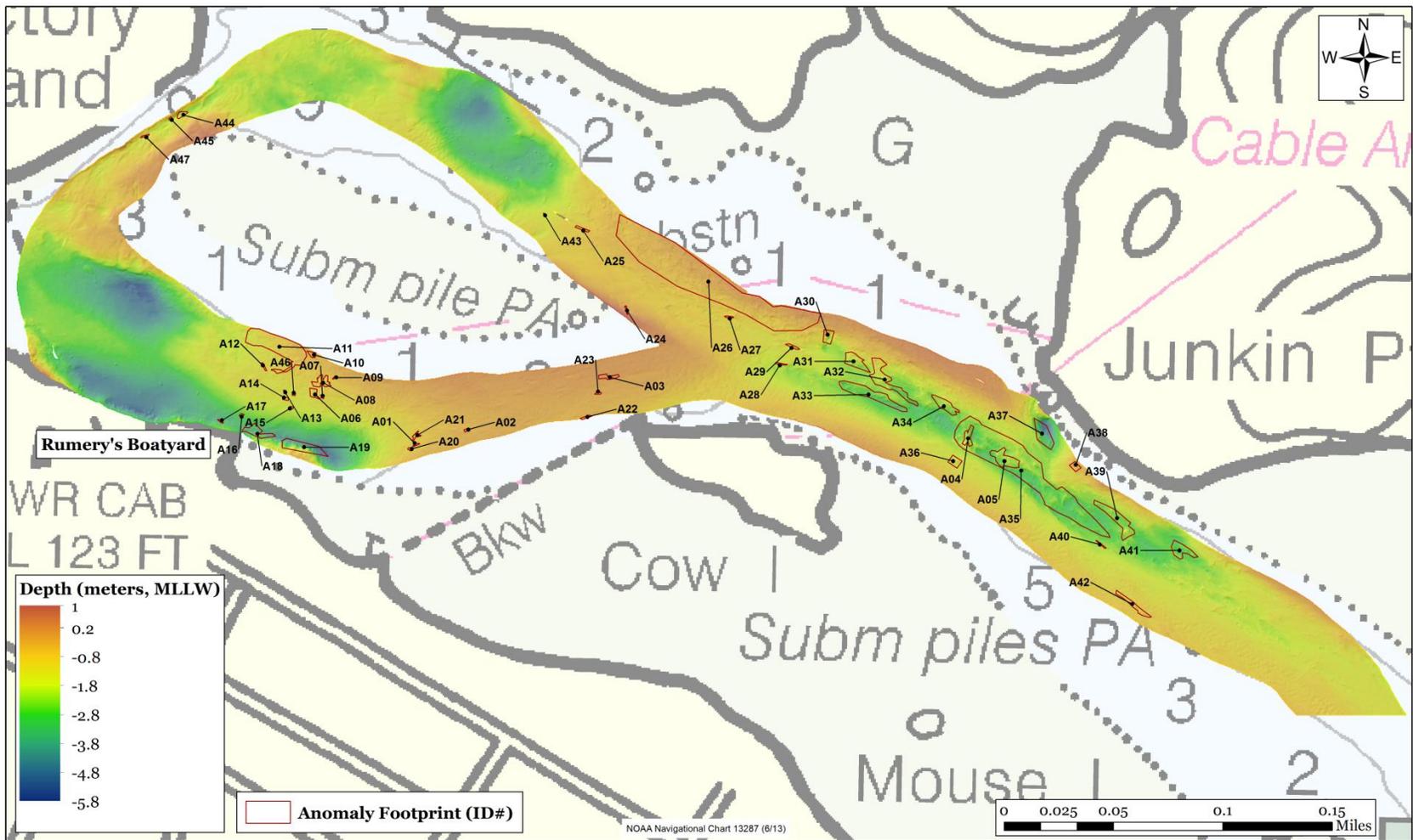
**Video notes:** *Times shown (minutes:seconds:milliseconds) in the following notes denote time elapsed from start of recording. Green lasers in video are spaced 10cm apart for scale but appear in frame intermittently.*

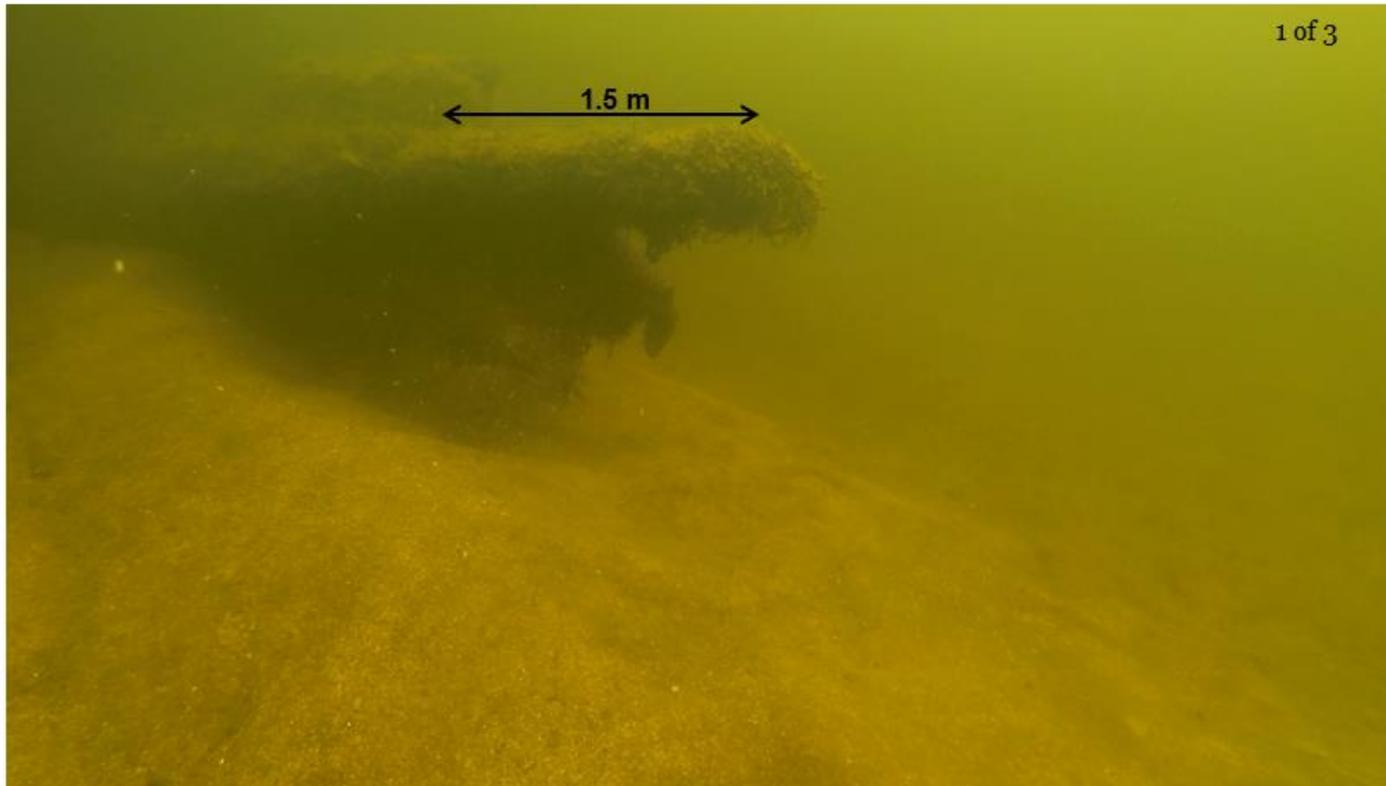
01:52:00 – suspected coarse woody debris pile

02:34:00 to 02:37:00 – large box-like frame of unknown composition extending vertically from riverbed; further investigation recommended

## **Appendix C – Overview Maps, Select Anomaly Illustrations, and Imagery Screenshots**



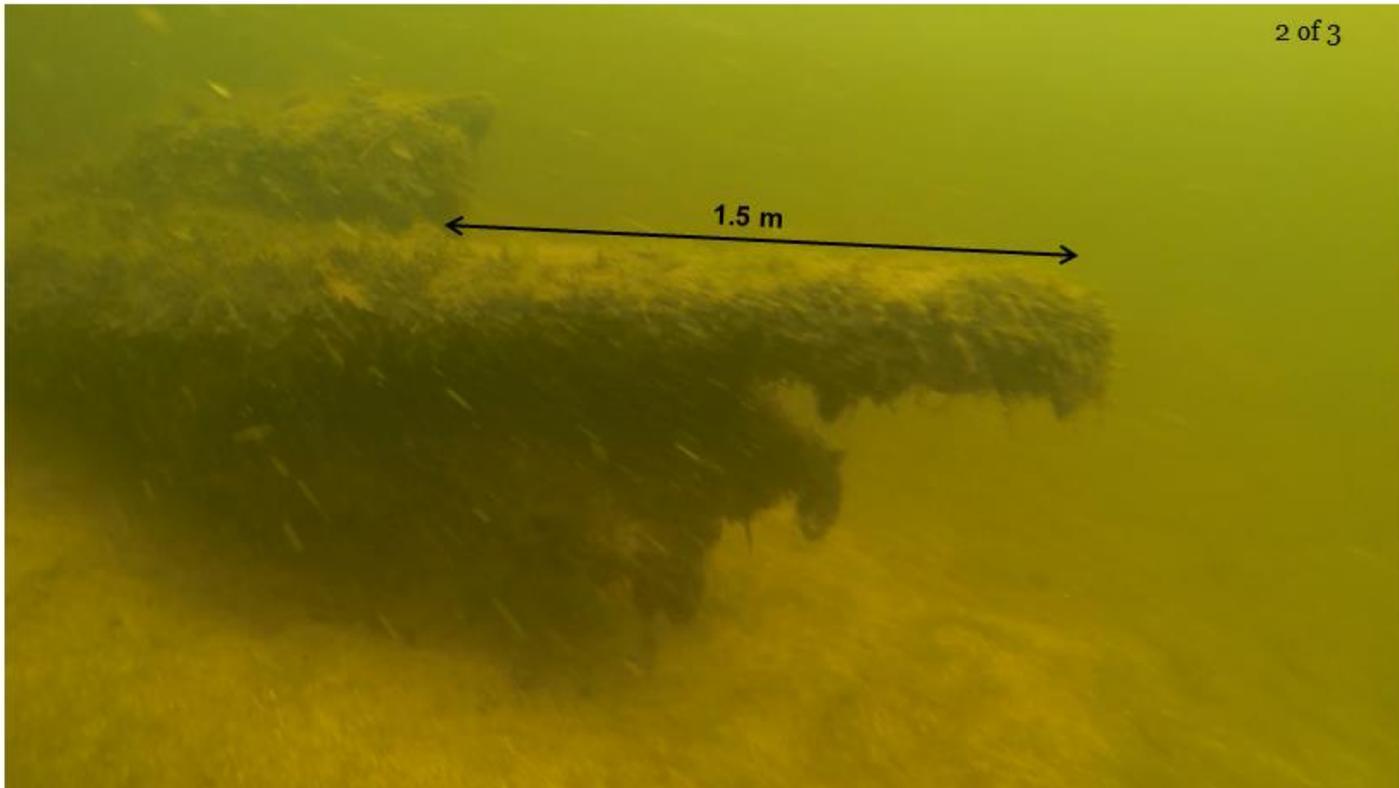




Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.

Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

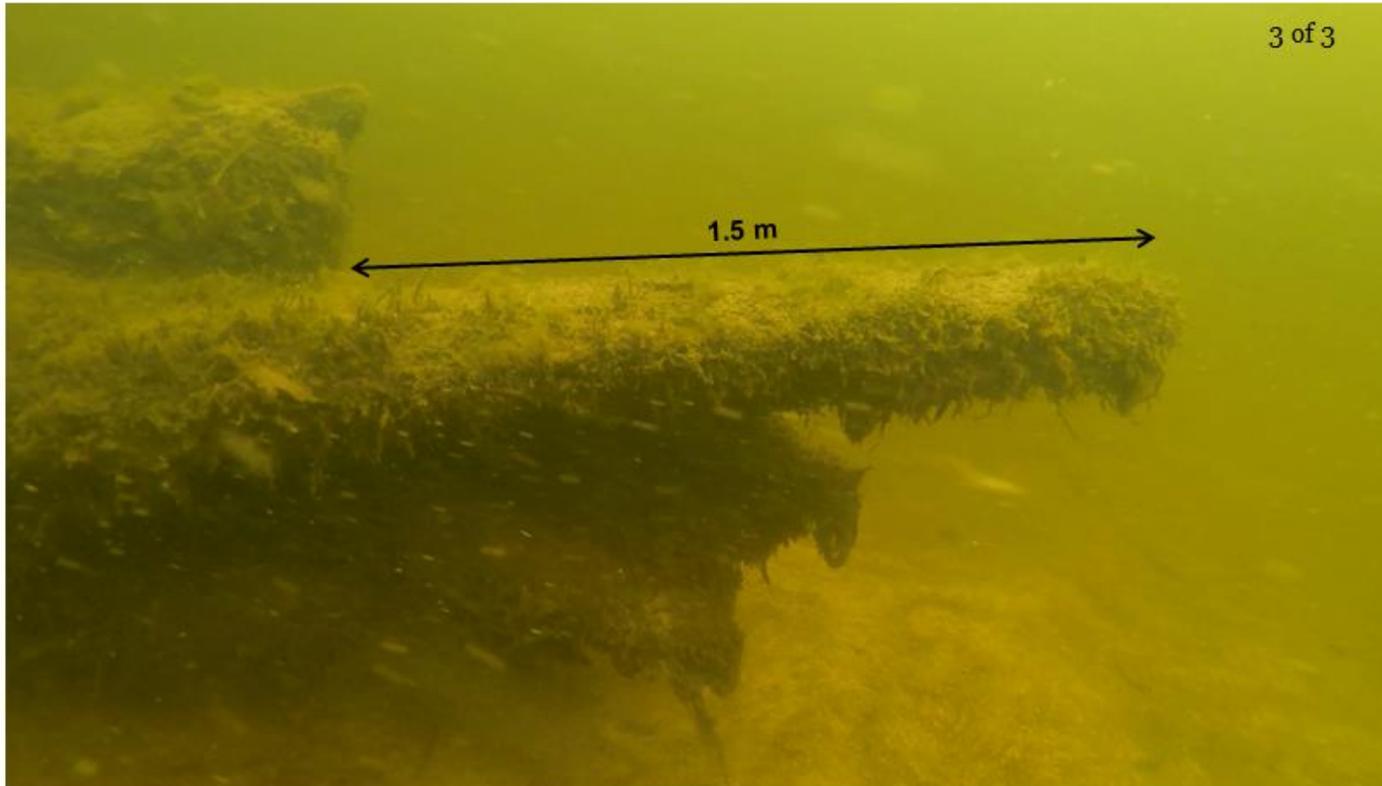
	Project Location:	Saco River, ME	Anomaly ID:	A1
	Method:	camera drop/tow	Easting (m):	383314
	Date/Time (EST):	5-25-16 / 10:23	Northing (m):	4816416
	Camera Bearing:	285 °	Shape:	elongate/irregular
	Depth (m):	2.2	File name:	gopr0337.mp4



Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.

Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

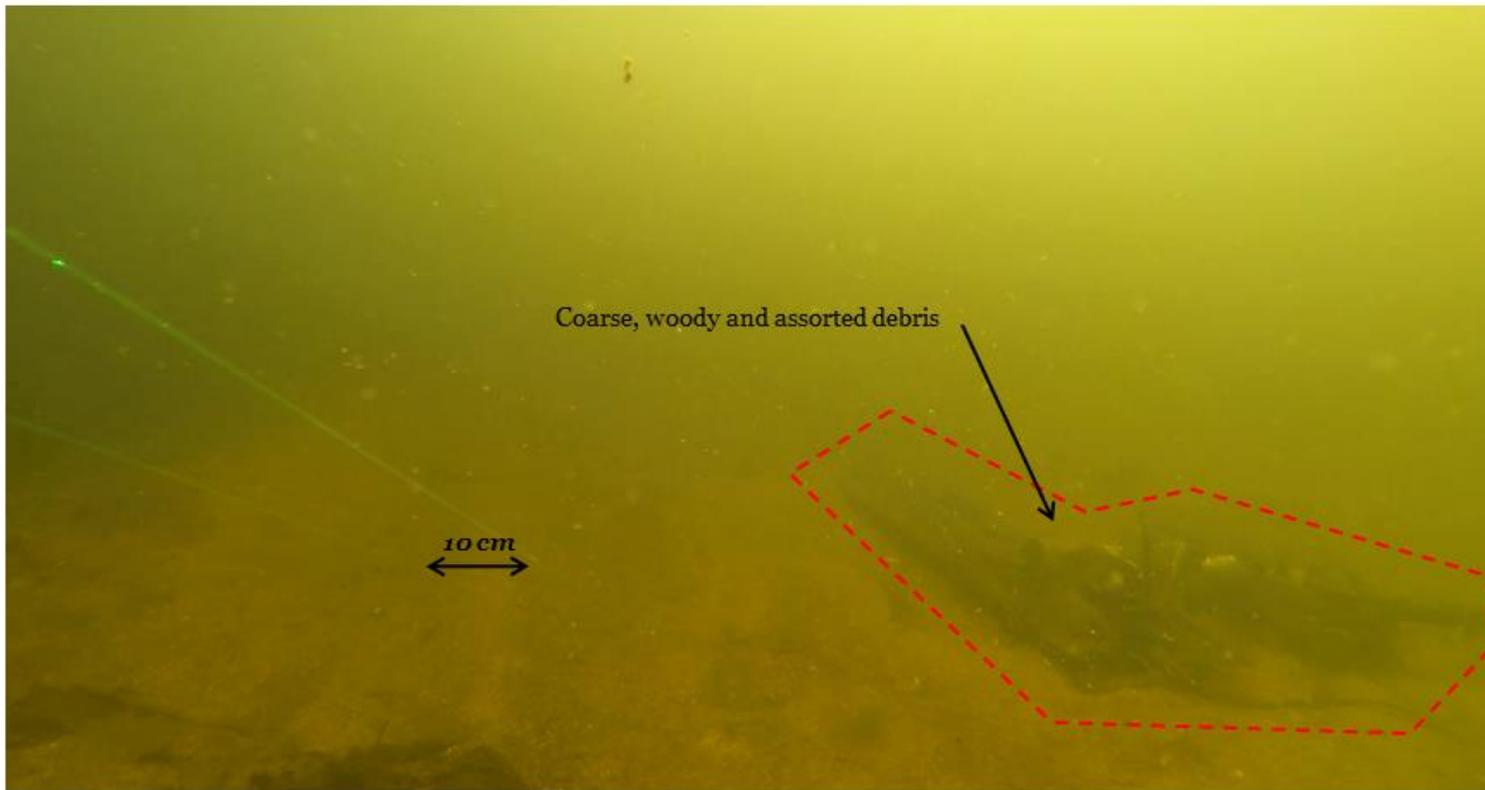
  	Project Location:	Saco River, ME	Anomaly ID:	A1
	Method:	camera drop/tow	Easting (m):	383314
	Date/Time (EST):	5-25-16 / 10:23	Northing (m):	4816416
	Camera Bearing:	340° (approx.)	Shape:	elongate/irregular
	Depth (m):	2.2	File name:	gopr0337.mp4



Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.

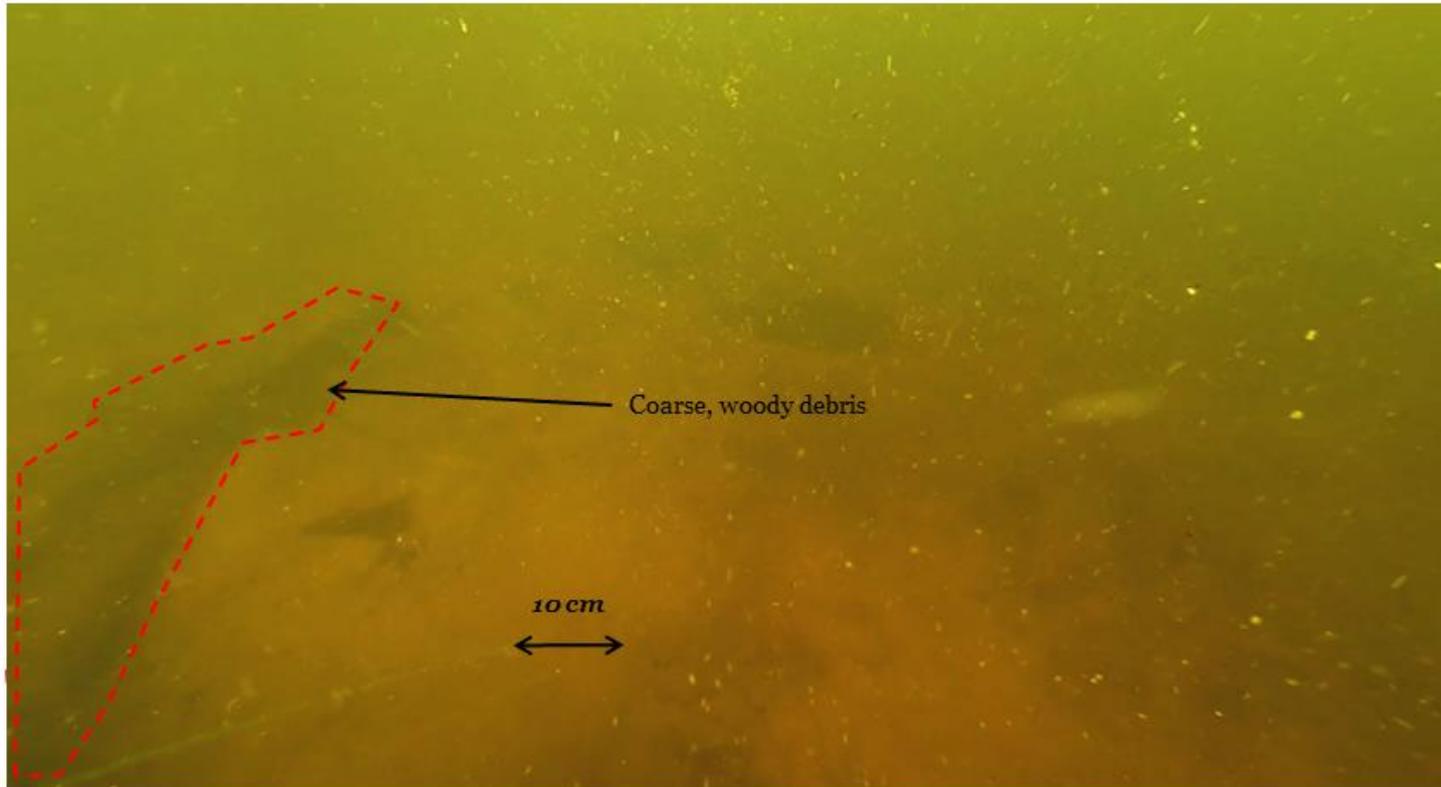
Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

	Project Location:	Saco River, ME	Anomaly ID:	A1
	Method:	camera drop/tow	Easting (m):	383314
	Date/Time (EST):	5-25-16 / 10:23	Northing (m):	4816416
	Camera Bearing:	350 ° (approx.)	Shape:	elongate/irregular
	Depth (m):	2.2	File name:	gopr0337.mp4



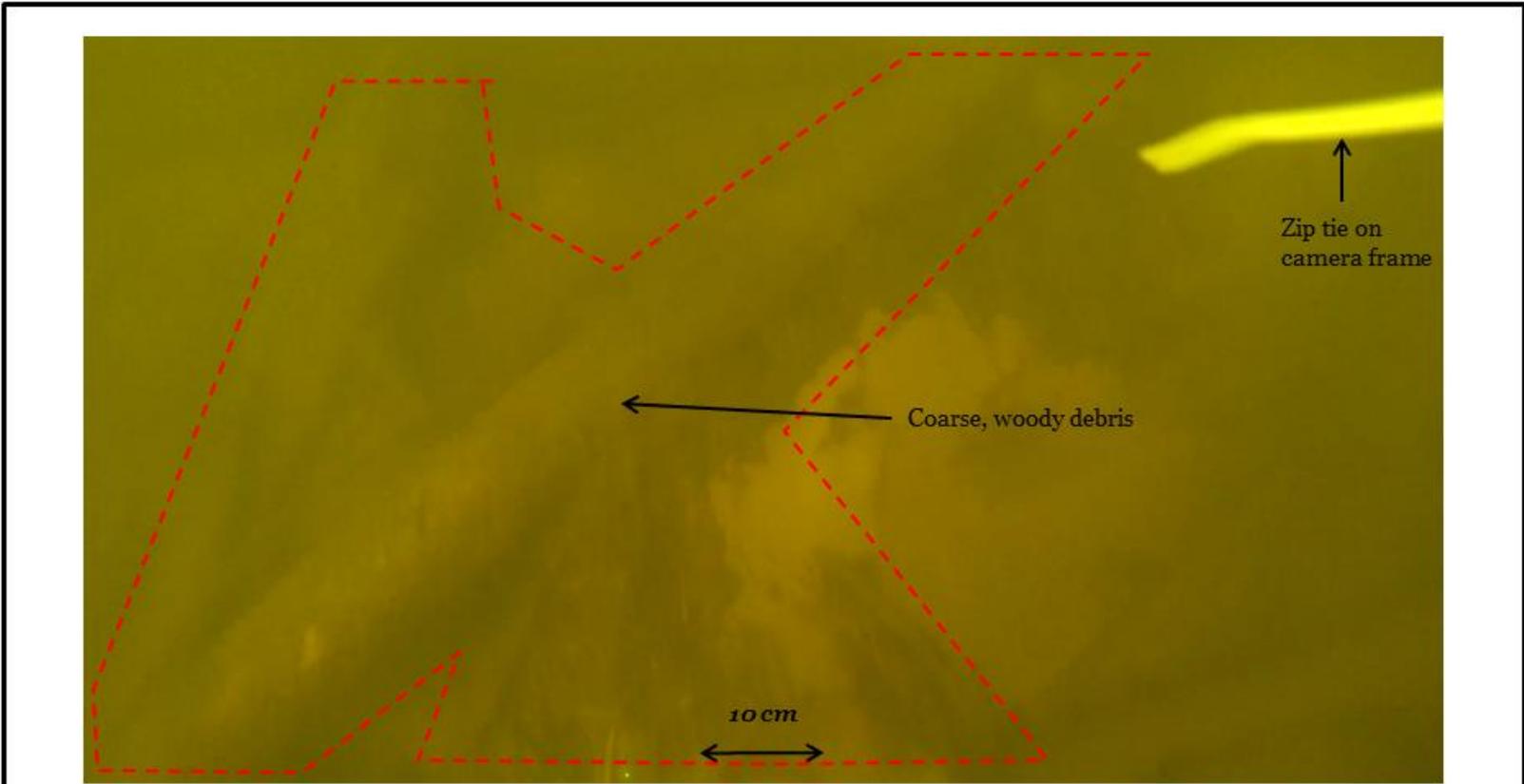
Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.   *Anomaly Footprint (approx.)*  
 Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

  	Project Location:	Saco River, ME	Anomaly ID:	A2
	Method:	camera drop	Easting (m):	383347
	Date/Time (EST):	5-25-16 / 10:52	Northing (m):	4816427
	Camera Bearing:	63°	Shape:	linear/irregular
	Depth (m):	2.0	File name:	gopr0338.mp4



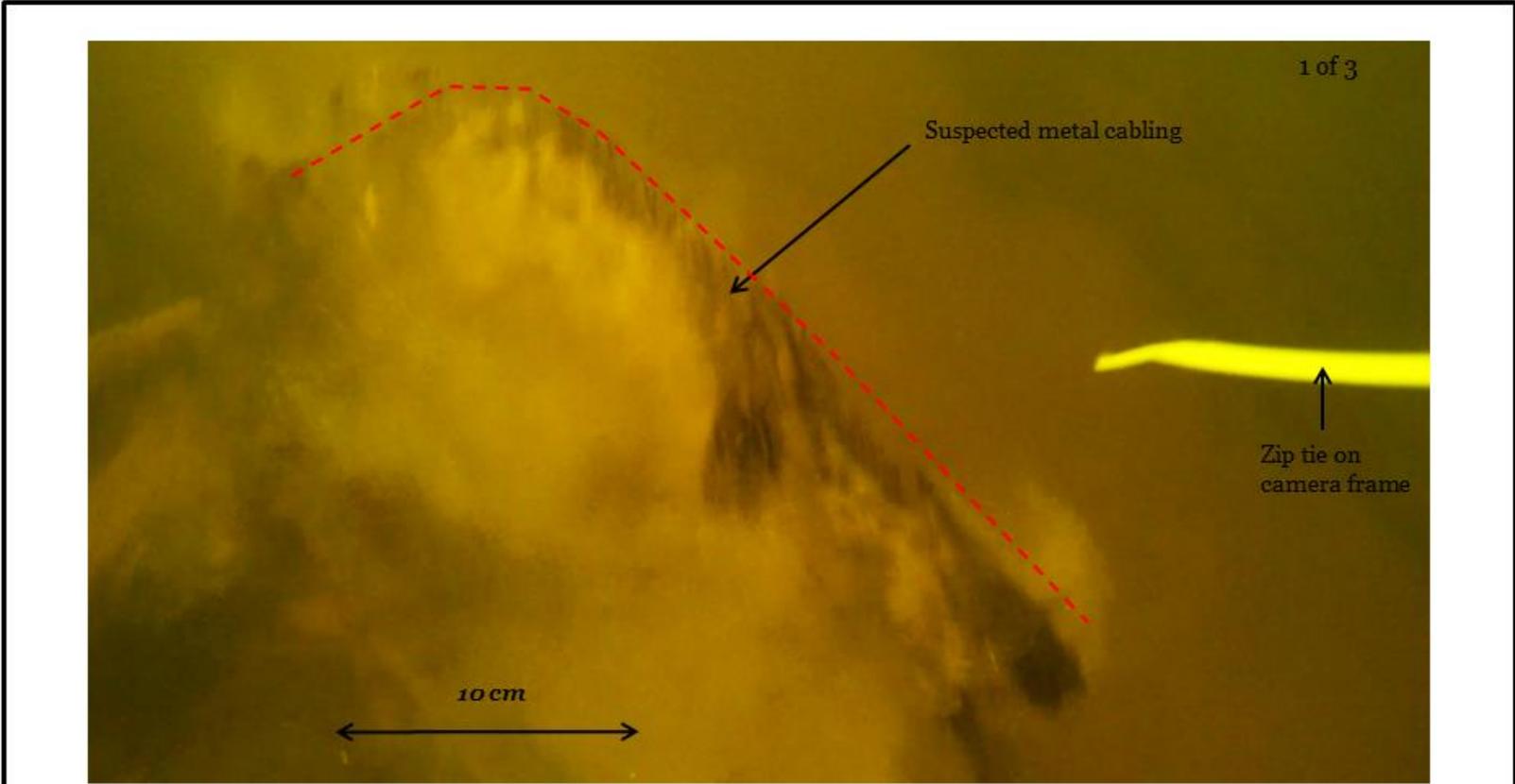
Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.   Anomaly Footprint (approx.)  
 Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

  	Project Location:	Saco River, ME	Anomaly ID:	A3
	Method:	camera tow	Easting (m):	383456
	Date/Time (EST):	5-25-16 / 11:57	Northing (m):	4816465
	Camera Bearing:	88°	Shape:	linear/irregular
	Depth (m):	~2.0	File name:	gopr000341.mp4



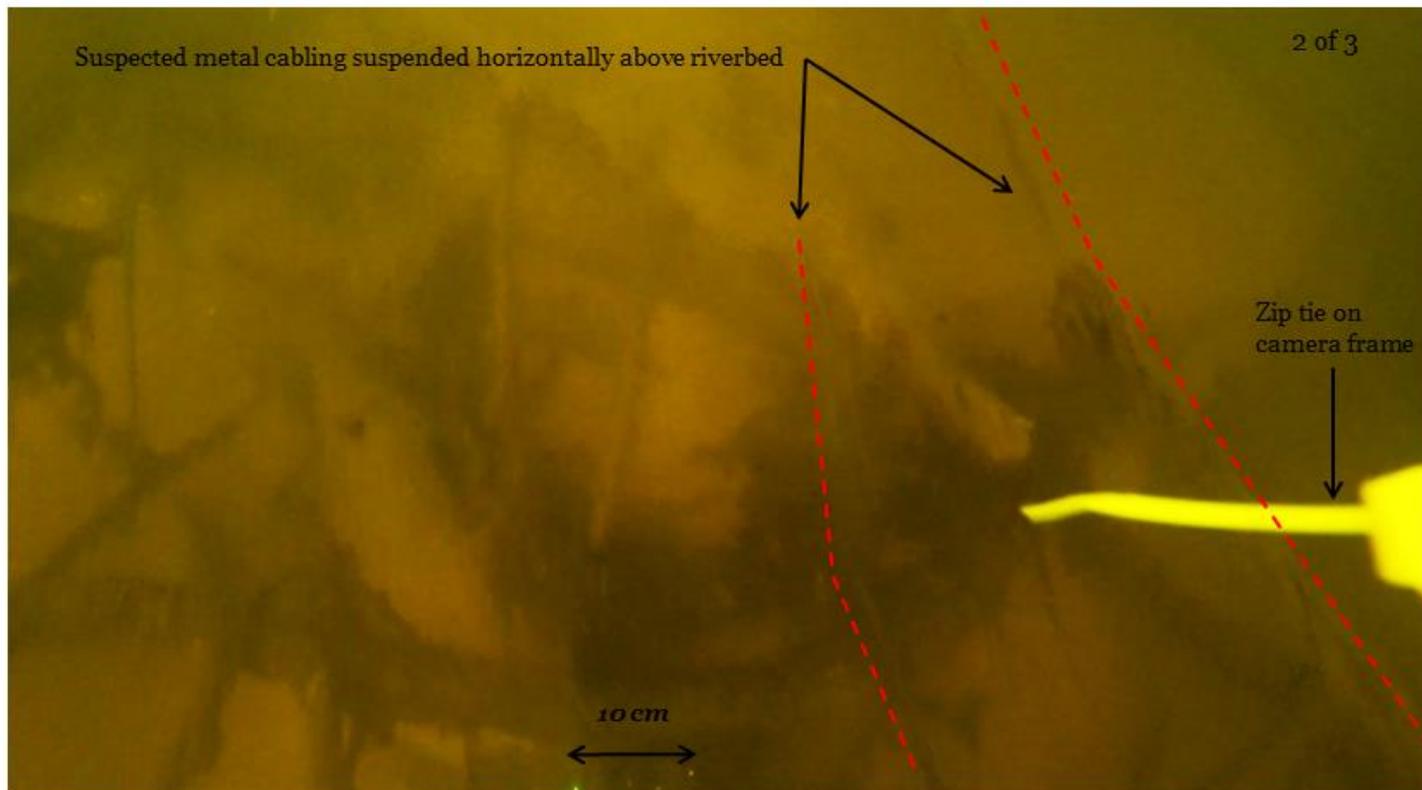
Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.    *Anomaly Footprint (approx.)*  
 Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

	Project Location:	Saco River, ME	Anomaly ID:	A4
	Method:	camera tow	Easting (m):	383720
	Date/Time (EST):	5-25-16 / 13:06	Northing (m):	4816422
	Camera Bearing:	303°	Shape:	Irregular/elongate
	Depth (m):	~4.0	File name:	gopr00346.mp4



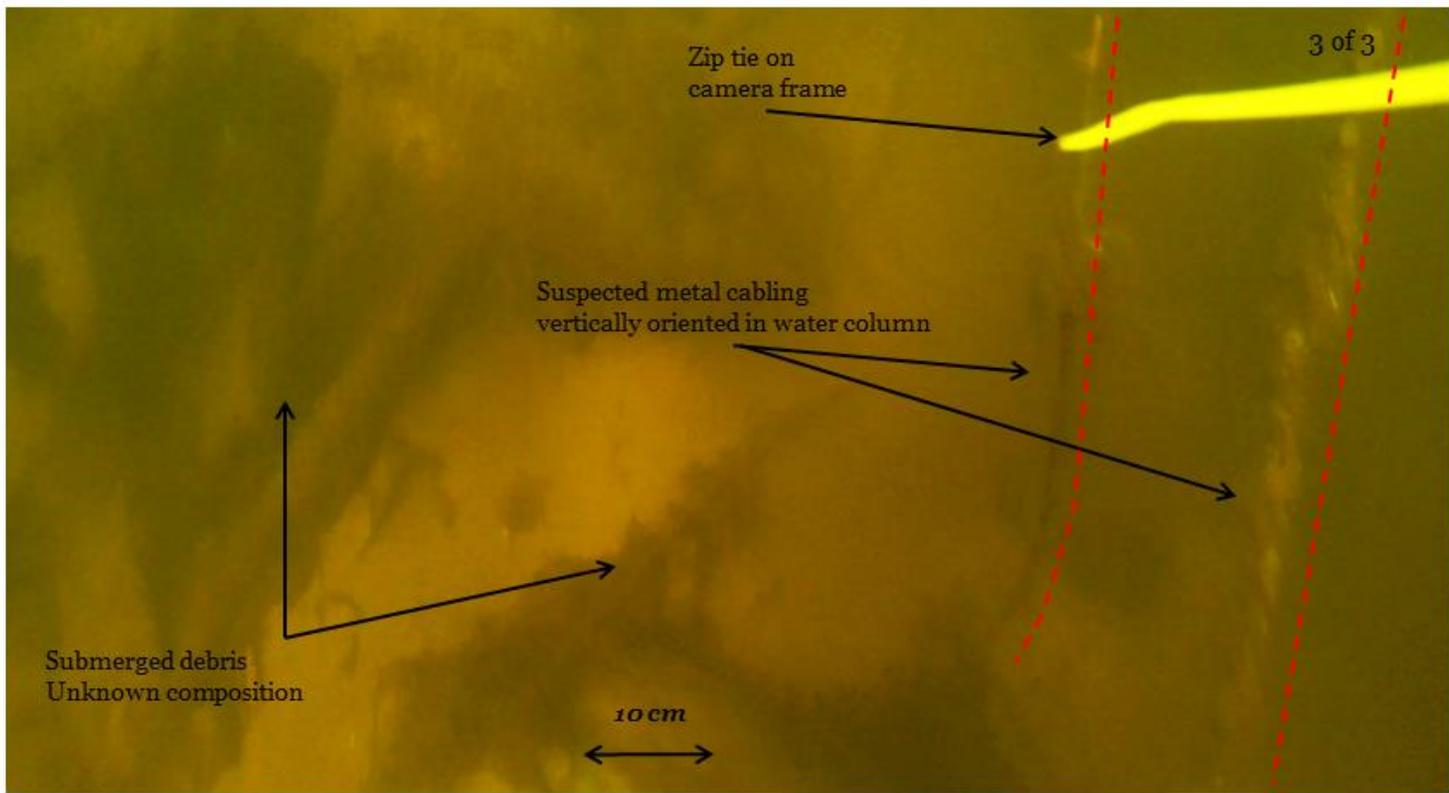
Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.   *Anomaly Footprint (approx.)*  
 Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

  	Project Location:	Saco River, ME	Anomaly ID:	A5
	Method:	camera tow	Easting (m):	383742
	Date/Time (EST):	5-25-16 / 13:07	Northing (m):	4816408
	Camera Bearing:	303°	Shape:	irregular
	Depth (m):	~4.0	File name:	gopr00346.mp4



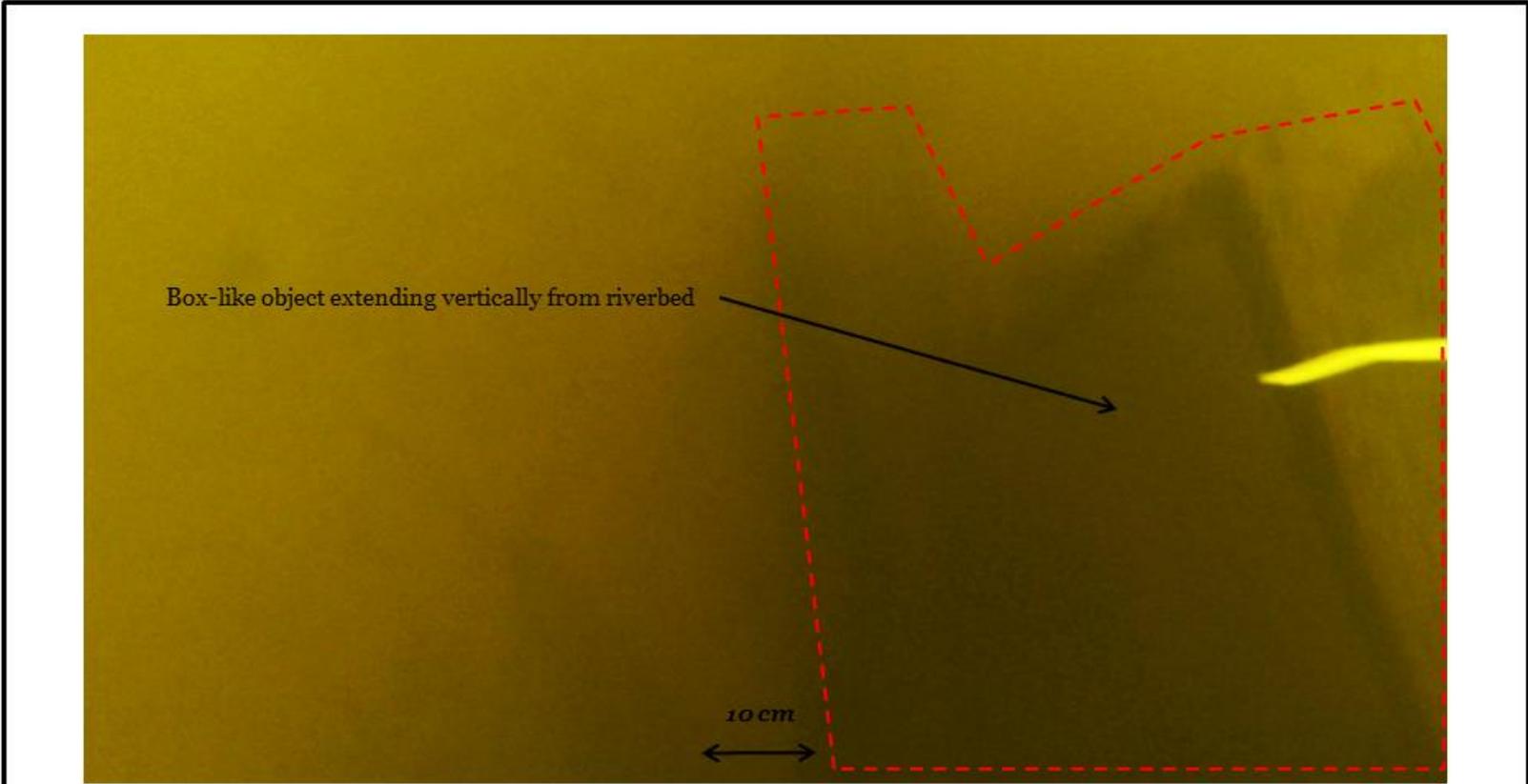
Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.   Anomaly Footprint (approx.)  
 Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

  	Project Location:	Saco River, ME	Anomaly ID:	A5
	Method:	camera tow	Easting (m):	383742
	Date/Time (EST):	5-25-16 / 13:07	Northing (m):	4816408
	Camera Bearing:	303°	Shape:	linear/irregular
	Depth (m):	~4.0	File name:	gopro00346.mp4



Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.   Anomaly Footprint (approx.)  
 Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

  	Project Location:	Saco River, ME	Anomaly ID:	A5
	Method:	camera tow	Easting (m):	383742
	Date/Time (EST):	5-25-16 / 13:07	Northing (m):	4816408
	Camera Bearing:	303°	Shape:	linear/irregular
	Depth (m):	~4.0	File name:	gopro00346.mp4



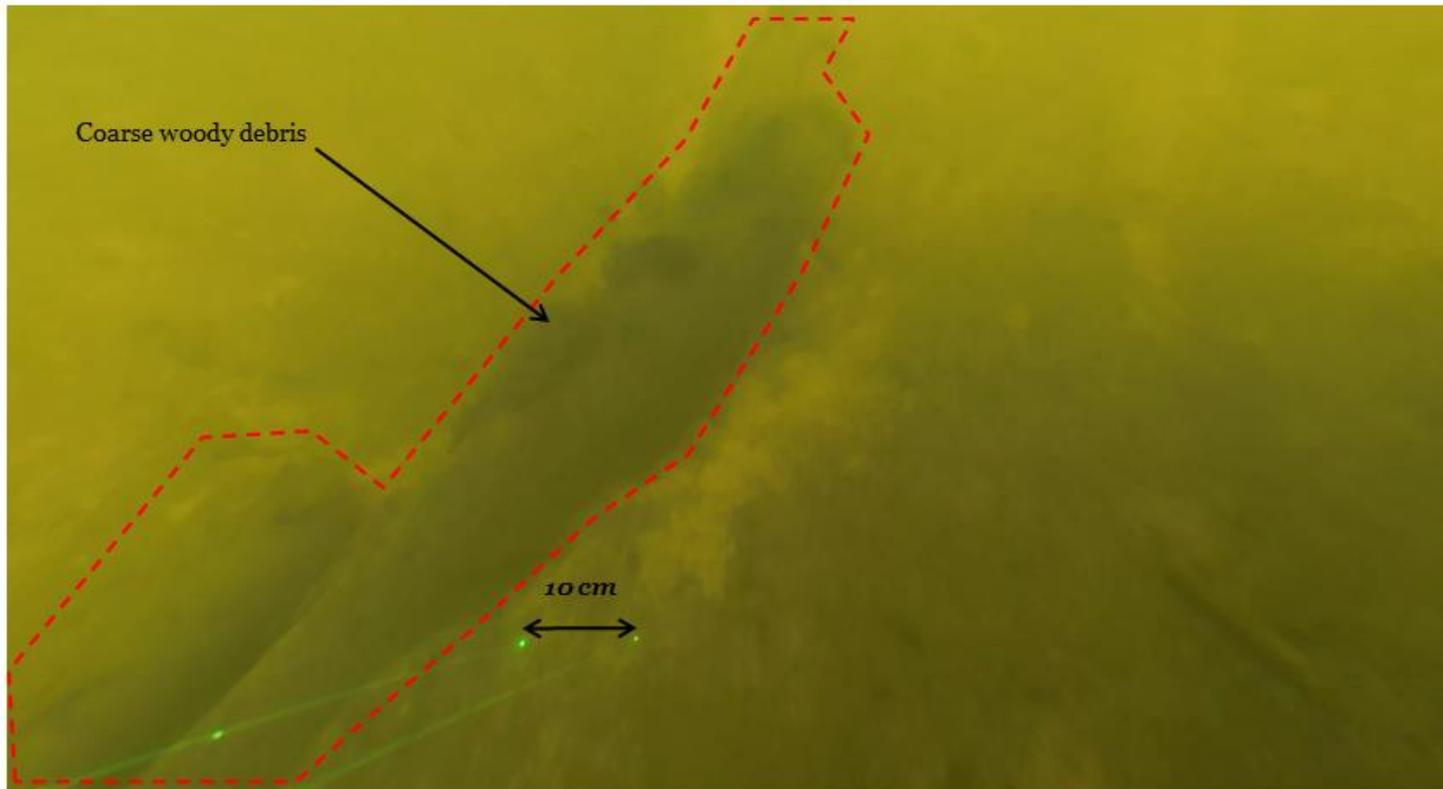
Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.    *Anomaly Footprint (approx.)*  
 Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

	Project Location:	Saco River, ME	Anomaly ID:	A6
	Method:	camera tow	Easting (m):	383238
	Date/Time (EST):	5-25-16 / 13:41	Northing (m):	4816454
	Camera Bearing:	93°	Shape:	polygonal/irregular
	Depth (m):	~2.0	File name:	gopr00347.mp4



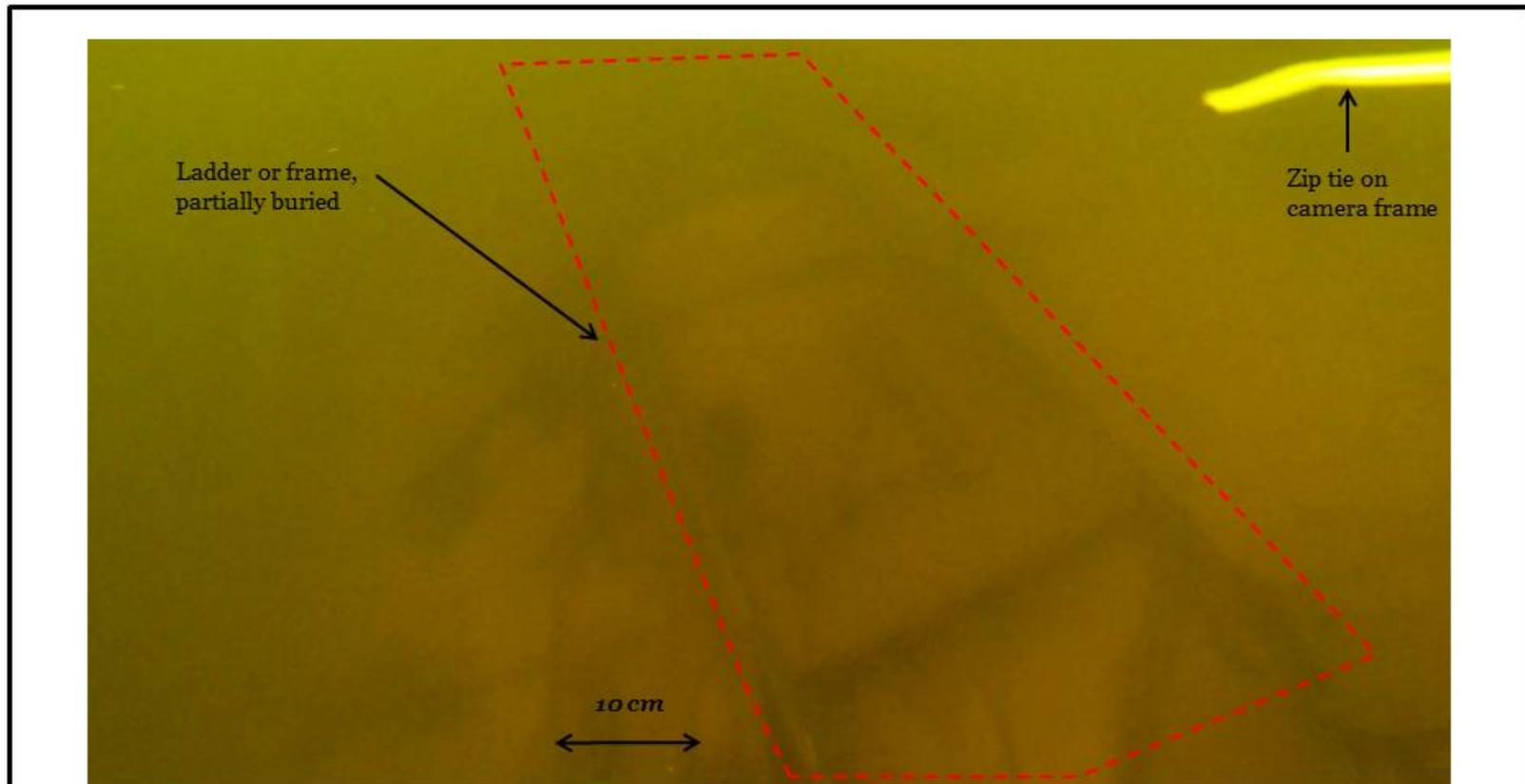
Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.    *Anomaly Footprint (approx.)*  
 Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

	Project Location:	Saco River, ME	Camera Tow ID:	4
	Method:	camera tow	Easting (m):	See tow coords.
	Date/Time (EST):	5-25-16 / 11:57	Northing (m):	See tow coords
	Camera Bearing:	88°	Shape:	linear/irregular
	Depth (m):	~2.0	File name:	gopro00341.mp4



Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.    *Anomaly Footprint (approx.)*  
 Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

	Project Location:	Saco River, ME	Camera Tow ID:	4
	Method:	camera tow	Easting (m):	See tow coords.
	Date/Time (EST):	5-25-16 / 11:57	Northing (m):	See tow coords.
	Camera Bearing:	88°	Shape:	linear/irregular
	Depth (m):	~2.0	File name:	gopr000341.mp4



Depths were recorded in real-time and represent depth from sea surface to seafloor in vicinity of anomaly.   *Anomaly Footprint (approx.)*  
 Coordinates listed in projected coordinate system WGS84 UTM Zone 19N (meters).

	Project Location:	Saco River, ME	Camera Tow ID:	8
	Method:	camera tow	Easting (m):	See tow coords.
	Date/Time (EST):	5-25-16 / 13:06	Northing (m):	See tow coords.
	Camera Bearing:	303°	Shape:	polygonal
	Depth (m):	~4.0	File name:	gopr00346.mp4