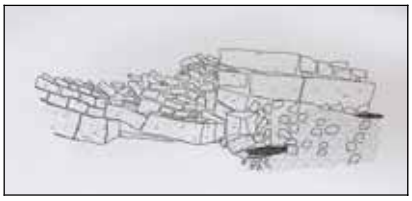
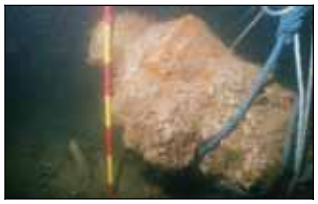
Appendix O

Underwater Archaeological Assessment

Corrib Onshore Pipeline

Marine Geophysical Data Interpretation, Underwater Archaeological Assessment and Inter-tidal Inspection

THE ARCHAEOLOGICAL DIVING COMPANY LTD.

Corrib Onshore Pipeline

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1st May 2010

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THE ARCHAEOLOGICAL DIVING COMPANY LTD.

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EXECUTIVE SUMMARY

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The 2007 archaeological assessment was carried out across Sruwaddacon Bay, reviewing the geophysical data acquired, conducting an inter-tidal foreshore inspection of the Bay, and a dive inspection of the sub-tidal zone. The work was carried out under licence from the Department of the Environment, Heritage and Local Government (DoEHLG). The current study focuses on the 4.9km section of the pipeline, most of which will be tunnelled beneath Sruwaddacon Bay, between Aghoos (located approximately 1.5km north-northeast of the Gas Terminal at Bellanaboy) and Glengad, in north County Mayo.

Desktop assessment has not identified material of archaeological significance within the bay area. However, cartographic sources indicate the presence of an active river channel running along the south side of the bay in the nineteenth century, which has subsequently become inactive.

The marine geophysical survey was comprehensive, and indicated a relict paleo-channel running through the bay. A series of geophysical anomalies were identified and those located within the Bay were diver-truthed as part of the underwater/ inter-tidal assessment. Four anomalies, SS6, SS29 SS11, and SS26 (see figure 11) are located within the impact corridor identified for the revised pipeline route. None of the anomalies are deemed to retain archaeological significance.

Systematic visual inspection of the foreshore/ inter-tidal and sub-tidal seabed areas in 2007 did not reveal any material or features of archaeological significance. In addition, four sections of intertidal foreshore (Areas 1-4) were re-inspected in April 2010 in light of the revised pipeline route through the

Sruwaddacon Bay and following discussions with the DoEHLG. Onsite work revisited the upper foreshore and intertidal areas at Aghoos and Glengad and did not reveal any material or features of archaeological significance.

The conclusion of the present survey is that the known archaeological potential within Sruwaddacon Bay is low. The possibility nevertheless remains that subsurface deposits retain archaeological material, and palaeo-channels would be ideal holding areas for such material. This is especially the case for all-wooden constructions, such as log boats and other pre-modern sailing craft and related features, since geophysical prospecting is unable to detect buried timber features of such character.

This report recommends that further in-water work in advance of construction is not required.

The pipeline will be constructed by tunnelling under the Bay, avoiding all known archaeological features, and no impact on marine archaeology is anticipated.

The method of pipeline insertion requires the excavation of a starting pit at Aghoos and a reception pit at Glengad. These works represent a potentially significant impact on the existing environment and it is recommended that a programme of archaeological monitoring be conducted during construction, with the proviso to resolve fully any archaeological material that is observed at that point. It is also recommended that a programme of monitoring be allowed for during the tunnelling process, but that the requirement be reassessed as progress is made. Archaeological monitoring should be undertaken if an intervention pit is required for the purposes of this tunnelling work.

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1.0 INTRODUCTION

The Archaeological Diving Company Ltd (ADCO) was appointed by RPS on behalf of Shell E & P (Ireland) Ltd, to interpret marine geophysical data, and carry out foreshore/inter-tidal survey, and underwater archaeological assessment in Sruwaddacon Bay, Co. Mayo, as part of the Environmental Impact Statement (EIS) being prepared for the Corrib Onshore Pipeline Project. The following report considers the foreshore and in-water areas associated with the pipeline route.

The proposed onshore pipeline will extend approximately 8.3km from where the offshore pipeline makes landfall at Glengad to the permitted Gas Terminal at Bellanaboy. The proposed pipeline route will run in a south-easterly direction in Sruwaddacon Bay, from the tunnelling compound (SC2) at Glengad to the tunnelling compound (SC3) in Aghoos, where it will continue on a landward route to the Gas Terminal at Bellanaboy (Figures 1-2). The pipeline will also transect a small inlet located in the southeast corner of Sruwaddacon Bay. The inlet is the discharge location for a small stream and forms the boundary between Aghoos townland and Bellagelly South townland.

Sruwaddacon Bay forms a narrow estuarine inlet off Broadhaven Bay and south of Rossport, Co. Mayo. It is fed by the Glenamoy River to the southeast, and measures c. 4.5km in length and c. 0.7km in width, extending north-westwards to its confluence with the lesser Ross Bay before emptying into Broadhaven.

The marine geophysical data was acquired by Osiris Projects Ltd for Shell E & P (Ireland) Ltd. A total of twenty-nine anomalies were visually inspected to ascertain their archaeological potential, as part of the onsite archaeological foreshore/ inter-tidal and underwater assessment carried out in 2007. Only four anomalies, SS6, SS9, SS13 and SS26 (see Figure 11), are located within the potential impact corridor identified for the proposed pipeline route. None of the anomalies are deemed to retain archaeological significance.

ADCO sought to:

- identify and record the location, nature, and dimensions of any archaeological features, fabric or artefacts that may be impacted by the proposed pipeline.
- make detailed recommendations for the mitigation of any archaeology present within Sruwadacon Bay.

- make recommendations as to the options available to the client in the event of archaeology being present.

Particular attention was paid to recording seabed and foreshore topography, bottom composition, and highlighting any material concentrations. Following an archaeological review of the marine geophysical survey data acquired, an archaeological inter-tidal survey of Sruwaddacon Bay was completed on the 11th and 12th September 2007. The underwater assessment and diver-truthing of the side-scan sonar anomalies was completed on 11th and 12th of October 2007. Both surveys were carried out by a team of three maritime archaeologists and a certified Dive Supervisor. In addition, an experienced boatman and tender were provided to expedite the surveys. The assessment was carried out under licence from the Department of the Environment, Heritage and Local Government (DoEHLG), licence numbers: 07D038, 07D040, and 07R169, 07R170.

The foreshore and intertidal areas at Aghoos and Glengad (foreshore Areas 1-4) were recently revisited (April 2010) to assess the possibility for fresh information to have become exposed naturally on the foreshore locations of the pipeline landfalls. The work was carried out by two maritime archaeologists under licence from the DoEHLG; licence numbers 010D018, 010R034.

2.0 PROPOSED DEVELOPMENT

The proposed Corrib Onshore Pipeline consists of the following elements: [1]

- Onshore Gas Pipeline
- Landfall Valve Installation
- Umbilicals and Services
- Outfall Pipeline

The proposed development will comprise approximately 8.3km of onshore pipeline extending from the landfall at Glengad to the permitted Gas Terminal at Bellanaboy.

[1] The following elements are considered in greater detail in Volumes 1 and 2 of the Environmental Impact Statement. What follows in the present report is an overview of the proposed Onshore Pipeline development.

Pipeline Construction Techniques

It is proposed to install the gas pipeline and services in a 4.9km long segment lined tunnel. This tunnel will run in a south-easterly direction between the townlands of Glengad and Aghoos. The tunnel will be constructed as a segment lined tunnel. The pipeline will also transect a small inlet located in the southeast corner of Sruwaddacon Bay. It is understood that an open-cut construction method will be adopted for this estuary/ river crossing.

It is proposed that the tunnel into which the pipeline is installed is constructed below a water body, generally without excavating from the surface. These methods are designed to minimise the amount of surface disturbance required during construction.

Construction of the Corrib Onshore Pipeline in Sruwaddacon Bay will be by a tunnelling technique generally known as segment lining. Segment lined tunnelling will be used to first construct a concrete lined tunnel. The onshore pipeline and associated utilities will then be installed within the tunnel. This technology uses a Tunnel Boring Machine (TBM) to gradually excavate a tunnel underneath the bay. As the excavation moves forward, new sections of tunnel are assembled directly behind the TBM. The excavated material from the tunnel will be pumped back along the tunnel to the surface through hoses. The tunnelling operation will involve the construction of a starting pit at the tunnelling compound (SC3) in Aghoos and a reception pit at the tunnelling compound (SC2) at Glengad. The operation is carried out from the starting pit and proceeds towards the reception pit.

If a problem is encountered, it may be required to excavate from the surface via an intervention pit. The intervention pit would be sheet-piled and excavated using conventional land-based excavation equipment. This equipment would be deployed from a pontoon or barge set-up.

It is proposed to construct the tunnel with a minimum depth of cover of 5.5m. It is anticipated that the majority of materials encountered during the tunnelling process will be sands and gravels.

Aghoos Tunnelling Compound

A temporary tunnelling compound (SC3) is to be located within the townland of Aghoos, NGR: 85596E, 335345N (centre-point). The compound will be divided into two sections, the pipeline stringing area and the tunnelling construction compound. If an intervention pit is required during construction a temporary shore access point will also be located immediately north of the tunnelling construction compound.

- *Pipeline stringing area*: this area measures 20,643m^2. It is anticipated that the stringing area will be constructed by excavating the top layer of peat that covers the site to within approximately 0.5m - 1.0m of the peat base and the resulting area will be in-filled using imported stone. When construction is complete, a regulation layer of peat will be spread upon the stringing area before surface layers are replaced to reinstate the area.

- *Construction compound*: this compound will measure 23,964m^2 and is located immediately northwest of the pipeline stringing area. The top layer of peat that covers the site will be excavated to within approximately 0.5m - 1.0m of the peat base and the resulting area will be in-filled using imported stone. When construction is complete, a regulation layer of peat will be spread upon the stone compound before surface layers are replaced to reinstate the area.

- *Temporary shore access point*: this area will allow access to Sruwaddacon Bay in the event that an intervention pit is required during the tunnelling works. The area encompasses both the upper foreshore and inter-tidal zone at this location, stretching across a 121m (north-south) x 138m (east-west) area.

- *Tunnel start pit*: this will be located within the compound and will measure 20m in length and 9m in width.

Glengad Tunnelling Compound

A temporary tunnelling compound (SC2) is to be located within the townland of Glengad, NGR: 819356E, 338545N (centre-point). The compound will measure approximately 3,500m^2. The tunnel reception pit will be located within the compound and will measure 27.5m in length (east-west) x 7.5m in width (north-south).

Pipeline Insertion, Watercourse Crossing Point

A section of pipeline will extend, from Aghoos in a south-easterly direction to the Gas Terminal at Bellanaboy. This landward section of pipeline will cross a small inlet and watercourse located in the south-easternmost corner of the Bay. The watercourse (Leenamore River) forms the townland boundary between Aghoos to the west and Bellagelly South to the east. An open trench-method will be used to lay the pipeline at this location. It is anticipated that the trench will measure 6m width (north-south) x 40m length (east-west).

3.0 SURVEY METHODOLOGY

A desktop assessment of cartographic and archival information was conducted as a preliminary stage of archaeological assessment for the project. The desktop assessment included an examination of the Ordnance Survey mapping for the area since the First Edition six-inch series in 1839, as well as an examination of the topographical files in the National Museum of Ireland and the Sites and Monuments Record in the Department of the Environment, Heritage and Local Government, with specific attention to the Inventory of Historic Shipwrecks. In addition, the record of licensed archaeological work was consulted and relevant published sources were reviewed.

The following legislation, standards and guidelines were considered and consulted for the purposes of this evaluation:

- National Monuments Acts, 1930-2004;
- The Planning and Development (Strategic Infrastructure) Bill, 2006;
- The Heritage Act, 1995;
- Guidelines on the information to be contained in Environmental Impact Statements, 2002, EPA;
- Advice Notes on Current Practice (in preparation of Environmental Impact Statements), 2003, EPA;
- Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes, NRA
- Frameworks and Principles for the Protection of the Archaeological Heritage, 1999, (formerly) Department of Arts, Heritage, Gaeltacht and Islands;
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 2000 and the Local Government (Planning and Development) Act 2000; and
- Code of Practice between Bord Gáis Éireann and the Minister for Arts, Heritage, Gaeltacht and the Islands (now the Department of Environment Heritage and Local Government), 2002.

The marine geophysical survey data acquired by Osiris Ltd was issued for review and archaeological interpretation. The geophysical survey was also inspected by ADCO during its operation. ADCO was provided with a full and complete record of the data available and examined this information with a view to highlighting particular anomalies that may be considered to retain archaeological potential and to inform subsequent archaeological fieldwork. The examination also sought to present

overview images of the nature of the sub-surface portion, as indicated in the side-scan sonar data.

The on-site archaeological fieldwork was carried out following the data review and under licence from the Department of the Environment, Heritage and Local Government (DoEHLG), licence numbers: 07D038, 07D040, and 07R169, 07R170. The full extent of the inter-tidal foreshore of Sruwaddacon Bay was field-walked at Low Water and included the foreshore areas opposite the starting pit at Aghoos and the reception pit at Glengad. The field-walking was undertaken by a team of three archaeologists, supported by boat cover from a rigid inflatable boat (RIB), skippered by a third party provided by the client. A detailed written record, supplemented by photographic record, of the foreshore environment was made and a hand-held GPS was used to position-fix the survey route and any observations made.

The sub-surface or sub-tidal element of the survey was conducted in a similar manner. Visual inspection was employed to assess the archaeological potential of the seabed within Sruwaddacon Bay. A team of three maritime archaeologists (certified to a minimum of HSE Part III diving certification) and a certified dive supervisor conducted the work, using a mobile surface-supplied diving set-up. Maximum coverage of the underwater inspection area was achieved using a diver-towed survey method. The dive survey was carried out to HSE/HSA standards using Surface Supplied Diving Equipment and all relevant safety equipment.

Inspection of the sub-tidal geophysical anomalies was undertaken using circular searches from an anchored down-line that was centred on the anomaly coordinates, which were pinpointed using the boat's Differential GPS receiver. Geophysical anomalies located within the inter-tidal zone were inspected at Low Water and position-fixed using a hand-held GPS.

Magnetometry survey by hand-held metal-detection was undertaken across two areas deemed suitable for metal-detector use (as identified on Figure 9); strong currents within the bay made metal-detection use impractical along much of the underwater survey area. However, the geophysical survey carried out by Osiris supplemented this information and the absence of metal-detector information did not form a constraint to the study. A Fisher Aquanaut 1280X underwater metal-detector was used to conduct the survey (Plate 1).

Both the underwater and the inter-tidal survey areas were examined. Detailed descriptions were made of topography and bottom composition. A photographic

record of the existing environment was made and, where possible, metal-detector anomalies were inspected and mapped.

Four areas of intertidal foreshore were revisited in April 2010. This recent on-site assessment used the same methodological approach to that of 2007 under licences 010D018, 07D034.

Limitations

No limitations were encountered during the surveys and the full extent of the inter-tidal foreshore of Sruwaddacon Bay has been field-walked at Low Water, and the sub-tidal zone has been dive inspected.

Classification of Impacts

The impact categories listed below have regard to those set out in the 'Guidelines on the information to be contained in Environmental Impact Statements', 2002, EPA, 'Advice notes on Current Practice (in preparation of Environmental Impact Statements), 2003, EPA, and Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes, National Roads Authority.

Impacts are generally categorised as either being a direct impact, an indirect impact or as having no predicted impact:

Direct impact occurs when an item of archaeological heritage is located within the centreline of the proposed route alignment and entails the removal of part, or all, of the monument.

Indirect impact may be caused where a feature or site of archaeological interest is located in close proximity of the proposed development.

No predicted impact occurs when the proposed route option does not adversely or positively affect an archaeological heritage site.

These impact categories are further assessed in terms of their quality i.e. positive, negative, neutral (or direct and indirect).

Negative Impact: a change that will detract from or permanently remove an archaeological monument from the landscape.

Neutral Impact: a change that does not affect the archaeological heritage.

Positive Impact: a change that improves or enhances the setting of an archaeological monument.

A significance rating for these impacts is then given i.e. slight, moderate, significant or profound.

Profound: applies where mitigation would be unlikely to remove adverse effects. This is reserved for adverse, negative effects only. These effects arise where an archaeological site is completely and irreversibly destroyed by a proposed development.

Significant: an impact which, by its magnitude, duration or intensity alters an important aspect of the environment. An impact like this would be where the part of a site would be permanently impacted upon leading to a loss of character, integrity and data about the archaeological feature/site.

Moderate: a moderate direct impact arises where a change to the site is proposed which though noticeable, is not such that the archaeological integrity of the site is compromised and which is reversible. This arises where an archaeological feature can be incorporated into a modern day development without damage and that all procedures used to facilitate this are reversible.

Slight: an impact which causes changes in the character of the environment which are not significant or profound and do not directly impact or affect an archaeological feature or monument.

Imperceptible: an impact capable of measurement but without noticeable consequences.

In addition, the Duration of Impacts is assessed and has been sub-divided into the following categories.

Temporary Impact:	Impact lasting for one year or less
Short-term Impacts:	Impact lasting one to seven years
Medium-term Impact:	Impact lasting seven to fifteen years
Long-term Impact:	Impact lasting fifteen to sixty years.
Permanent Impact:	Impact lasting over sixty years

4.0 THE RECEIVING ENVIRONMENT

4.1 Cartographic Information

An early map of Mayo (1830) shows Sruwaddacon Bay in simplified form with a water channel running centrally through the bay flanked by tidal mudflats on either side (Plate 2). The map also shows a ferry point at the mouth of the bay, and a sequence of shoals-like features extending into the channel off the southern shore.

A more detailed map is provided in the Ordnance Survey First Edition six-inch map series dated to 1839 (Figure 3). The map shows the estuarine nature of Sruwaddacon Bay with large expanses of tidal mudflats and sandbars. In contrast with the present-day topography of the bay, the river channels depicted on the 1839 map appear to be wider and a second channel is shown running along the southern shore of the bay, below a large mudflat expanse. Today that southern channel has all but disappeared, and waters flowing from the Glenamoy and Muingabo rivers are directed northwards along a single main channel that runs through the bay at Low Water.

From an archaeological perspective, one can expect certain discrete indicators of maritime cultural heritage on nineteenth-century maps, such as fish traps and eel weirs, if not actual shipwreck sites. The location of traps and weirs on tidal mudflats in an estuarine context is to be expected, where advantage is taken of the access provided to fish during the tidal cycle.[2] However, there are no such indicators of fishing features on the 1839 map within Sruwaddacon Bay. The only feature indicated along the foreshore is a ferry crossing point at the north end of the bay. The small house located beside the crossing point on the east shore was no doubt for the use of the ferryman.

In the time since 1839, the bay has seen certain change, both in terms of the infilling of the southern channel, and the more extensive development of the ferry crossing point at the north end of the bay (Figure 4). However, little else has changed and the tongue-like sand-bars remain very much as they were in the 1830s.[3]

[2] The potential of intertidal archaeology is perhaps most comprehensively set out in Aidan O'Sullivan, *Foragers, Farmers and Fishers in a Coastal Landscape. An intertidal archaeological survey of the Shannon Estuary* Discovery Programme Monograph 5 (Dublin 2001), especially chapters 5-6.

[3] The present-day aerial views reproduced in Figure 2 continue to show this pattern, and it should be noted that the photographs were taken at a time when the tide was high, whereas the mapped data reproduced on Figures 3-4 show the Low Water levels.

4.2 Desktop Data

There are no artefacts recorded in the topographical files of the National Museum of Ireland provenanced to Sruwaddacon Bay.

Terrestrial Sites

The land-based archaeological record in the area around Sruwaddacon Bay is focused at the head of the bay in Glengad where there is an interesting selection of largely prehistoric period monuments (Figure 4). These include a wedge tomb grave (MA004-023) that is located c. 350m west of the shoreline, and a cist grave (MA004-017) situated only 125m from the shore. These sites present a clear sense of the appreciation of access to the shore by peoples in the distant past and suggest the potential for settlement and other remains in the immediate area. A little to the south, in Kilcommon or Pollotomish and Carnhill townlands, the cluster of sites relating to a church, graveyard and Holy Well (MA011-005, 006) indicate that access to the bay and through the bay remained important into the historic period. Perhaps it is due to the presence of blanket bog that there are few charted sites as one moves into the bay area, and indeed the north shore is quite barren. The absence of settlement here on the 1839 map suggests too that the clearance of bog to create the ribbon of development that is noticeable today, along both shores, is of very recent date.

The clearance of bog raises a most important facet of the archaeology of northwest Mayo, since it is below the blanket bog at Céide, Belderrig and at Behy/Glenulra that Seamas Caulfield has championed the discovery of a prehistoric agricultural landscape that reaches back to the first moments of sedentary existence in the Neolithic period.[4] Caulfield's innovative field techniques realized that the blanket bog grew over and buried an actively managed landscape, and has preserved much of it intact. The piecemeal exploitation of the bog as a source for turf, and its cutting away to create new areas for houses presented important opportunities to see the lines of stone walls and the sites of settlement and burial associated with the prehistoric landscape. The extension of such bogland into Sruwaddacon Bay cautions archaeologists and suggests the possibility of similarly rich insight to the distant past. As it happens, however, there has not been any discovery reported of buried prehistoric landscapes in the area immediately surrounding the bay, and as such the known potential is low. While one may conclude that the existing archaeological record highlights activity on either side of the entrance to Sruwaddacon Bay, and that the insights are less clear as one proceeds into the bay, especially on the north side,

[4] S. Caulfield, R. G. O'Donnell, P. I. Mitchell, '14C dating of a Neolithic field system at Céide Fields, County Mayo, Ireland', *Radiocarbon* 40 (1998): 629-40; see also Graeme Warren, Fieldwork in 2006 at Belderrig, Co. Mayo, 04E0893, unpublished report.

the absence of known sites should not be considered to correspond to an absence of archaeology. The presence of so much blanket bog may simply be serving to mask these features.

The Record of Monuments and Places lists seventeen sites for the townlands surrounding Sruwaddacon Bay and these are tabulated below (Table 1/ Figure 4):

RMP Number:	National Grid Reference:	Townland:	Site Type:	Closest distance from Pipeline Route:
MA004-010-001	798870E, 338190N	Glangad or Dooncarton	Promontory Fort	1.9km
MA004-010-002	798870E, 338190N	Glangad or Dooncarton	Castle, Unclassified	1.9km
MA004-010-003	798870E, 338190N	Glangad or Dooncarton	Building (s)	1.9km
MA004-010-004	798870E, 338190N	Glangad or Dooncarton	Hut site	1.9km
MA004-011	802380E, 338441N	Glangad or Dooncarton	Promontory Fort	1.5km
MA004-012	810656E, 335215N	Glangad or Dooncarton	Megalithic Tomb	716m
MA004-013	810405E, 338215N	Glangad or Dooncarton	Stone Circle	716m
MA004-015	817176E, 338416N	Glangad or Dooncarton	Enclosure	241m
MA004-016-001	827207E, 338291N	Rosdoagh	Megalithic Tomb	375m
MA004-016-002	827207E, 338291N	Rosdoagh	Enclosure	375m
MA004-017	821439E, 338140N	Glangad or Dooncarton	Cist	207m
MA004-023	819934E, 337889N	Glangad or Dooncarton	Megalithic Tomb	442m
MA004-024	826705E, 339720N	Rosdoagh	Ringfort/ Cashel	1.4km
MA011-005-001	826454E, 337012N	Kilcommon or Pollatomish	Church	615m
MA011-005-002	826454E, 337012N	Kilcommon or Pollatomish	Graveyard	615m
MA011-006	852785E 333752N	Kilcommon or Pollatomish	Ritual site, Holy Well	975m

Table 2: List of RMP sites located within the general vicinity of Sruwaddacon Bay.

Shipwreck Sites

The Shipwreck Inventory in the Department of the Environment, Heritage and Local Government's archive is a list of recorded instances of wrecking since 1750. The details provided describe the type of vessel, the journey it foundered on, and information on the ultimate plight of the vessel and its crew, where possible. In describing the wrecking event, the records will locate the incident in relation to the nearest headland or other topographic marker where known. This is not a record of where the wreckage lies, however, since the historic records generally only deal with

the vessel before it sank. Such finer details emerge from other sources, such as fishermens' records of snag points and diver records of sites located underwater. These are included in the Inventory wherever possible, but it is true to say that most entries lack this final level of data. It should also be pointed out that while the inventory provides a record of wrecking incidents since 1750, it does not claim to be a comprehensive record for earlier events, and therefore the medieval and prehistoric periods are not represented in this archive.

In searching the Inventory for wrecks in Sruwaddacon Bay, a wider net was cast to include Broadhaven Bay in general (Table 2). The results suggest that recorded wreckings on this stretch of coastline are relatively few, but this might have more to do with the under-populated landscape than anything else, since there would have been fewer people regularly observing shipping movements than on the more densely populated stretches of coastline. If this was true for the active coastline, the relative absence of settlements on Sruwaddacon Bay even up to 1839 might explain the lack of wreckings reported in the bay.

Vessel Name:	Date of loss:	Location:	Description:
Albion	12th November 1847	Broadhaven Bay	Sailing Vessel
Alliance	15th October 1902	Inver	Schooner
Annie	14th January 1893	Broadhaven Bay	Brig
Ann Worthington	October 1841	Broadhaven Bay	Brig
Arab	18th December 1823	Broadhaven Bay	Brig
California	5th October 1853	Broadhaven Bay	Emigrant Ship
City of Limerick	29th November 1850	Broadhaven Bay	Schooner
Emerald	12th January 1847	Broadhaven Bay	Sailing Vessel
Favourite	17th March 1807	Broadhaven Bay	------
First Come	16th October 1905	Broadhaven Bay	Rowing Boat
Hawk	21st November 1881	Portacloy Beach	Wooden Lugger
John Willey	10th February	Broadhaven Bay	------
Magdala	14th April 1882	Broadhaven Bay	Brigantine
Maid of Mayo	1899	Porturlin Creek	Steel-hulled ship
Mary	16th July 1853	Broadhaven Bay	Sloop
Rain	24th april 1770	Erris	------
Ranger	12th July 1847	Erris Head	Sailing Vessel
River Nith	1892	Broad Haven Bay	Barque, Towed Off
Saint Anthony	27th May 1905	Brandy Point	Cutter
Sinai	1st January 1877	Inver	Brig
Santiago	1588	Poulatomsih	Armada Ship
Thetis	25th November 1819	Broad Haven Bay	------
Three Brothers	22nd March 1847	Broad Haven Bay	Sailing Vessel
Unknown	1588	Kid Island	Tender Vessel
Unknown	8th February 1822	Erris	------
Unknown	------	Inver Point	Dutch East Indiaman
Unknown	1851	Broad Haven Bay	Schooner
Unknown	*Unknown*	Inver	------
Unknown	*Unknown*	Inver	Two-masted vessel
Unknown	*Unknown*	Inver	Dutch warship
Unknown	*Unknown*	Inver	------
Unknown	*1640*	Poulatomish	Dutch East Indiaman

Table 3: Instances of shipwrecking recorded in the general area, based on the DoEHLG Historic Shipwreck Inventory.

Conclusions

The cartographic and desktop information indicate that the known archaeological potential within Sruwaddacon Bay in general is low, and that the area of the proposed crossing is equally low. However, the circumstances of under-population on the one hand, and the extension of blanket bog to the Bay edges must be taken into account and serve as a cautionary note when assessing the possible archaeological potential that could be exposed.

4.3 Marine Geophysical Data Review

The sources for assessment included:

- Side-scan Sonar Data Files on CD-ROM with CODA Geosurvey – Windows Version 4.0.2 operating system
- Magnetometer Profiles on CD-ROM
- Project Drawings showing tracklpots and position fixing, overlaid with Latitude and Longitude and Irish Universal Transverse Mercator grids.
- J. Walters, *Sruwaddacon Bay Geophysical Survey Report*, Preliminary Draft, September 2007, Osiris Projects Ltd.

The data was acquired by Osiris Projects Ltd. The survey operation was inspected by Dr. Niall Brady during the fieldwork phase on 13th July 2007, where it was possible to review the data acquisition process and discuss the project directly with the Osiris team. The record is comprehensive. The survey was collected in significant detail using side-scan sonar and magnetometry, supported by bathymetry.

Marine Geophysical Survey Equipment Used

1. Single beam echo sounder
2. Multi-beam echo sounder
3. Side-scan sonar, operating at dual frequency, towed
4. Sub-bottom profiler, Applied Acoustics AA200 Boomer System
5. Magnetometer, Geometrics G882, Caesium system

A programme of borehole drilling for site investigation was conducted in 2008 and the borehole logs were presented to ADCO for review.

Survey Grid

The survey lines provide an ample and adequate buffer area for a valid assessment. Figures 5-7 are reproduced from Osiris Projects Ltd showing the vessel trackplot maps, divided between the lower, the upper, and the outer sections of the bay. The maps show the extent of the cover conducted, with the main axis being along the length of the bay where a multitude of parallel survey lines were conducted. A system of crosslines was weaved at right angles tightly through the bay. The side-scan sonar and sub-bottom profile data was acquired simultaneously. The magnetometry data

was acquired separately. The trackplot maps distinguish between the deployments. Vessel fix points are indicated on the maps, with periodic fixes numbered on the maps to make them legible. Data was acquired using Irish Transverse Mercator, and this grid is overlaid onto the project drawings, as is that of Latitude and Longitude. It may be concluded that the survey was comprehensive and has provided ample opportunity to observe the same sections of seabed from different angles.

Bathymetry

Sruwaddacon Bay is mostly exposed at Low Water as an array of intertidal sand and mudflats. Water depths are shallow throughout, and are deepest in the narrow channel areas, where depths are all less than -4.5m Chart Datum. Comparison between the 1839 map and modern soundings, as reported by Osiris Ltd, not only shows the infilling of the southern channel through the inner half of the bay, but also reveals the mobile nature of the channel in the upper mid-section of the bay, where it is reworking the northwestern tip of the main mudflat island. If the bay is relatively impeded with sand and mudflats, these features are constantly being modified by the water passing through.

Side-scan Sonar Data

The data reveals a seabed within the survey area that is predominantly sand and mudflats. There is little evidence for rock exposure but perhaps one of the features particular to this part of the country is the presence of peat. Given the preservation of prehistoric landscape below the raised bog areas in nearby Behy/Glenulra and the Ceide Fields site, the presence of peat below the water surface in Sruwaddacon Bay is an obvious source of archaeological interest. The side-scan sonar imaging is very clear but it did not indicate features that might be associated with buried archaeological landscapes within Sruwaddacon Bay, such as lines of stone walls that might be jutting out from the edges of peat expanses. The peat was nevertheless noted and highlighted as locations that warranted inspection during the diving of the Bay.

A number of anomalies were identified in the data, and these are presented below in Appendix 2 and referred to in the text as SS#. They are mapped on Figures 10-12. Only one anomaly however suggested that it retained significant archaeological potential, SS20. This anomaly is not located within Sruwaddacon Bay, and is one of four anomalies detected by the surveyors off Ballyglass Pier. The anomalies that were identified within Sruwaddacon Bay have all been dive-inspected, and the findings are described in Appendix 2. While they are located throughout the bay, they are concentrated in the mid section with perhaps a focus towards the southern shore.

The anomalies range in type from natural features such as tree trunks (SS6-7) and kelp-festooned rock (SS4 and SS8), to modern debris (SS3 a car wheel; SS16-17 a machine part; SS25 an abandoned dog hutch), a pier head (SS28), and modern shoreline features, such as fence-lines (SS 29).

Only five anomalies, SS6 (Tree branch), SS9 (Peat) and SS11 (Peat), SS13 (Scour-hole), and SS26 (Mobile object) are located within proximity to the proposed pipeline route, being located within the corridor highlighted for the Temporary Working Area. No anomaly was directly over the pipeline route, and none of the anomalies indicated material of archaeological significance. The side-scan sonar data has not revealed material of archaeological significance in Sruwaddacon Bay.

Sub-bottom Profile Data

The sub-bottom profile survey was conducted in tandem with the side-scan sonar deployment. The detail reveals a sequence of natural variations at depth, which include the tracing of a buried river channel through the bay that pursues a slightly different course to the present-day river channel. Sediment thicknesses vary within the relict channel, from *c.* 8-10m at the south end of the bay, to *c.* 10-13m in the mid-section, deepening to *c.* 16-18m and up to *c.* 20m at the north end of the bay. Within the body of the bay, a strong reflector was observed and was thought by the surveyors to represent either coarser gravel, or a remnant peat. It is also possible that this represents a silty/clay level from a previous lower sea level. The presence of buried peats was indicated at the south end of the bay during borehole investigations at depths of between -9.3m and -9.8m and -7m below current seabed level.

The sediments that fill the former river channel would provide good holding content for archaeological material but there was an absence of archaeological indicators in the surface levels, where one might otherwise expect indications of buried manmade features, such as boats and ships. Figure 8 shows a typical sub-bottom profile acquired. The continuous horizontal alignment of the surface strata indicates the absence of manmade intrusions, while the arch-like shape of the reflected strata at depth indicates the presence of natural features which in this instance is interpreted as the rising east bank at the south end of the bay. The profile imaged in Figure 8 is taken from a sinuous trackplot that zig-zags across the bay. The central feature is where the vessel approached the shore from the southwest, and then proceeded away from it in a northwesterly direction.

Magnetometer Data

Magnetometry provides a different opportunity to assess the nature of the sub-surface environment. Specifically, magnetometry highlights variations in the metallic

content of the underlying levels, and therefore is suitable for identifying ferrous metal objects or features as well as natural geological variations. Magnetometry also penetrates below the seabed and can locate items that are buried.

The magnetometer survey in Sruwaddacon highlights natural variations within the bay that are explained geologically. The survey identified a single localised anomaly that may be related to human agency, located by Osiris at 84860mE, 336280mN, in the middle of the upper bay area, and to the southeast of SS24. The side-scan sonar data does not indicate a surface anomaly in this location and the dive survey conducted through the bay, which included this area, did not observe any feature on the seabed. The magnetic anomaly may be deemed to be buried.

The magnetometer has a focussed survey capability. Unlike side-scan sonar, which extends its beam to capture data either side of the survey device, magnetometry acquires its data directly below the instrument and therefore does not capture information that may lie on either side. This explains why, in the present context, the metallic debris identified in the side-scan sonar data (SS3 and SS16-17) were not highlighted in the magnetometry data. As Figure 9 shows in relation to SS3, the trackline of the magnetometer (in red) ran some distance to the northeast of the side-scan sonar anomaly location, and therefore did not highlight the feature.

Conclusion

The marine geophysical data acquired across Sruwaddacon Bay does not indicate archaeologically significant material on the seabed. However, this data works within its own limitations: side-scan sonar scans the surface of the seabed/riverbed but does not penetrate below the surface layers and cannot therefore indicate the presence or absence of material that is buried. While sub-bottom profiling and magnetometry both counter this limitation by identifying buried strata, they acquire data on a direct vertical section below the acquisition device. Therefore the devices only capture thin sections through any given area, and consequently there remain gaps in the record. In addition, magnetometry detects ferrous metal and does not claim to identify non-ferrous metal objects, such as copper and bronze. The possibility therefore remains that archaeological material survives undetected in Sruwaddacon Bay.

Bore holes

A series of fourteen borehole investigations were carried out in 2008, four located at the lower part of Sruwaddacon bay and the remainder at the upper part of the Bay (Figure 10). A band of buried peat was encountered in four boreholes at the upper part of the Bay, BHF007-08, BHF008-08 (rotary and percussive borehole) and BHF010-08. The peat bands extended for between 0.1m in thickness (BHF007) to

70cm in thickness (BHF10), and were located between -5.8m and -5.9m (BHF7), -9.3m and -9.8m (BHF8 percussive), -10.1 and -10.3m (BHF8 rotary) and -10.6m and -10.7m (BHF10) below current seabed level respectively. The borehole data gathered from this part of the Bay indicates that buried peat deposits may be impacted by the tunnelling works. An archaeological monitoring strategy is required during the tunnelling works to mitigate for these layers

5.0 ARCHAEOLOGICAL ASSESSMENT

The archaeological field assessment has been divided into four sections to allow separate discussion of the Inter-tidal Survey (section 5.1), Sub-tidal Survey (5.2), Foreshore Areas of Archaeological Potential (5.3), and Geophysical Anomaly Inspection (5.4).

5.1 Inter-tidal Zone

Foreshore topography

The inter-tidal zone at Low Water extends to cover the majority of Sruwaddacon Bay, leaving only a small central-channel that remains sub-tidal. Approximately 90% of the tidal seabed was inspected at Low Water and series of reference points were taken during the inter-tidal survey. The reference points run clockwise around the bay area, starting at the south-easternmost point of Sruwaddacon Bay. The reference points, coupled with topographic observations made, aim to highlight the existing inter-tidal environment and are listed below (Figure 11):

Reference Point 1, NGR: 857038E, 336089N (Plates 3-4, Figure 11): the upper foreshore is delineated by a raised peat-bog that is in excess of 1m in height and is covered with tufted sedge-grass, hawthorn, and other low-lying vegetation. The foreshore measures 29m in width at this location and is composed of coarse sands and gravels (<2mm) with frequent larger sub-angular and sub-rounded stones (size range: 0.04m x 0.05m – 0.08 x 0.10m). Larger rocks are also frequent within the foreshore make-up, ranging in size from 0.20m x 0.30m to 0.40m x 0.50m. These larger rocks are predominantly found close to the High Water Mean (HWM), smaller rocks being more frequent along the upper reaches of the foreshore. Seaweed (*Bladderwrack* species) predominates along the inter-tidal zone between the HWM and the Low Water Mark (LWM); the seaweed covering approximately 90% of the inter-tidal zone.

Reference Point 2, NGR: 854568E, 336221N (Plates 5-7, Figure 11): the upper foreshore is 12m in width at this location and is composed of a thin (>0.10m), grass-

covered deposit of peat with frequent rounded and sub-rounded stones (<0.10m x 0.10m). This area of foreshore is delineated by a 1m+ high deposit of silty-sand (fine-coarse sediments), light brown in colour, with frequent coarse gravel and rounded to sub-rounded stone inclusions. This deposit lies beneath a 1.25m deposit of raised peat-bog, covered by hawthorn, tufted sedge-grass, and mixed heather species. The inter-tidal zone measures 15m in width at Low Water and comprises of angular to sub-angular rocks covered with *bladderwrack* seaweed.

Reference Point 3, NGR: 852765E, 336404N (Plates 8-10, Figure 11): a mid-brown, silty-sand deposit measuring 0.75m in height delineates the foreshore at this location. A 0.30m deep deposit of topsoil overlies this silty sand and mixed grasses and low-lying vegetation line the top of the bank structure. The upper foreshore is composed of sub-angular and sub-rounded stones ranging in size from 0.05 x 0.08m – 0.10m x 0.14m. The upper foreshore measures 5-8m in width along this section, while the inter-tidal area has an increased width to 30m+.The inter-tidal area is composed of silty-sand (40%60% mix) with frequent stone, gravel, and crushed shell inclusions. As with the previous reference points there is a thick covering of seaweed (*bladderwrack*) across most of the inter-tidal zone; only becoming patchy towards the LWM.

Reference Point 4, NGR: 849893E, 336639N (Plates 11-13, Figure 11): the upper foreshore at this location is characterized by an isolated bedrock outcrop that shelves from a small rock-face (4m max. height) for a distance of c.10m to meet the HWM. At this point the topography changes, the inter-tidal zone being composed of coarse angular gravels and angular stones/ rocks; most likely eroded from the adjacent rock outcrop. Seaweed (*Bladderwrack*) is present across this area and covers approximately 70% of the inter-tidal zone.

Reference Point 5, NGR: 849890E, 336881N (Plates 14-16, Figure 11): this area of foreshore is delineated by a 1.5m-2.5m high deposit of silty-sand (fine-coarse sediments), light brown in colour, with frequent coarse gravel and rounded to sub-rounded stone inclusions. The deposit is pot-marked, and has small, cave-like, depressions in its face (average size 1mx 1m x 0.50m); most likely caused by the erosional effect of spring tides and storm waters within the bay. A thin layer of topsoil overlies this deposit which is covered with gorse bushes, hawthorn, and mixed grasses. The upper foreshore is composed of angular to sub-angular stones (size range: 0.02m x 0.04m x 0.08m x 0.12m), coarse gravels, and frequent concentrations of *saltmarsh* grasses. The upper three quarters of the inter-tidal zone is of similar composition to the upper foreshore, although the grass is replaced with extensive

seaweed (*bladderwrack*) cover. The lower reaches of this zone is composed of a silty-sand (10%/90% mix) that extends 5-10m to meet the LWM.

Reference Point 6, NGR: 846722E, 336881N (Plates 17-19, Figure 11): this area is characterized by an extensive sand bank that extends c.135m to the bay's central flow-channel. The sandbank is completely exposed at Low Water. It is flat and featureless; only occasional scouring being present around the rocks that infrequently dot its expanse. The upper reaches of the inter-tidal zone, measuring 20m in width, are composed of rounded to sub-rounded cobbles and large patches of seaweed. The upper foreshore area is delineated by a gently rising 1m+ high bank covered with long grasses and rushes. This upper area is composed of saltmash vegetation.

Reference Point 7, NGR: 839868E, 337119N (Plates 20-22, Figure 11): as with the previous reference point, this area is characterized by sandbank exposure at Low Water. Its extent measures 1480m east-west and a 450m north-south (at widest point); the central-flow channel meandering to the southern side of the bay to accommodate the sandbank. This sand deposit, while largely flat and featureless, has a number of large scour holes caused by modern debris protruding from the surface. Patches of kelp are evident within these scour holes, where the seaweed has anchored to the debris.

The sandbank is composed of a medium to fine-sand with quartz inclusions and fine crushed-shell fragments. Isolated, water rolled/ worn lumps of peat dot the sandbank, eroded from upstream peat deposits located at the confluence of the Glenamoy and Muingabo Rivers. The upper reaches of the inter-tidal zone are composed of sub-angular stone and rocks (size range: 0.02m x 0.04m x 0.08m x 0.12m) with occasional larger rocks measuring up to 0.40m x 0.50m in size. Seaweed covers much this zone, which measures approximately 12m in width. The upper foreshore area measures 10m in width and is delineated by a grass-covered bank measuring 2m+ in height.

Reference Point 8, NGR: 824673E, 3381851N (Plates 23-25, Figure 11): this area of foreshore is located at the waterway's narrowest point, c.1.4km from the mouth of Sruwaddacon Bay. The inter-tidal extent is greatly reduced along this section, measuring 10m in width, and is delineated by a steep, almost vertical, cliff-face measuring 5m+ in height. In several places the shelving-bedrock runs from the cliff-face down to the LWM. There is no upper foreshore zone along this stretch, the HWM extending to the base of the cliff. The inter-tidal zone is composed of large angular

rocks interspersed with smaller rocks and fragments of bedrock eroded form the cliff-face. Seaweed coverage is approximately 60-70% along this section.

Reference Point 9, NGR: 822662E, 339189N (Plates 25-27, Figure 11): this section of foreshore is located at the mouth of the Gweendany River Estuary, as it flows into the northwest extent of the bay, approximately 600m to the east of the bay's mouth. The inter-tidal zone measures 30m in width and is composed of fine sand deposits with frequent, large, angular rocks located along the upper reaches of the HWM. There is no upper foreshore area between the HWM and the base of a sloping grass covered bank, measuring 4-5m in height, which delineates the shoreline.

Reference Point 10, NGR: 822594E, 338480N (Plates 28-29, Figure 11): this reference point is located on the south-eastern limit of a large sand bank and sand dune system (c.300m x 300m area), located on the southern side of the mouth of Sruwaddacon Bay. This area is composed of a silty-sand (40%/60% mix) with frequent stone and crushed shell inclusions (approximately 30%). The silt content is increased along this area due to the deposition of river sediments along the eastern extent of the sand bank; these sediments being washed downstream through the central-flow channel from the Glenamoy and Muingabo Rivers. In addition, it was noted that due to this river deposition, several deposits within the sand bank comprise of 60% silt content with frequent tree branch and waterborne debris inclusions, including clumps of peat and other organic matter. Large sand dunes are located along the western limit of this area.

Reference Point 11, NGR: 822973E, 338067N (Plates 30-32, Figure 11): this section of foreshore is located on the southern side of the bay, adjacent to reference point 8, and is similar in composition to that of the northern side of the bay. A steep-sided, 60º, rock-face (8-10m in height) delineates the HWM along this section of shoreline. The rock-face is largely covered with overhanging vegetation and small trees. The inter-tidal zone measures 13m in width and is composed of shelving bedrock with overlying deposits of angular stone and coarse gravels. Large, angular rocks are intermittently located along this are and represent rock-fall from the adjacent rock-face. The inter-tidal zone is covered with a thick growth of *bladderwrack* seaweed and a large number of cockles and mussels were located along the LWM.

Reference Point 12, NGR: 824312E, 3378426N (Plates 33-34, Figure 11): the topography described for reference point 11 continues along this section for a distance of 200m (running eastwards). However, the inter-tidal zone increase in width

to 20m and a 4m wide area of upper foreshore now begins to be present. This upper area is composed of bedrock and overlying saltmarsh vegetation.

Reference Point 13, NGR: 824993E, 337704N (Plates 35, Figure 11): the rock face that previously delineated the shoreline is replaced by a tree lined, grass covered, embankment. A small stream runs through a ravine at NGR: 82468E, 337691N to discharge into the bay. The upper foreshore is composed of coarse gravels (<2mm), rounded to sub-rounded stones (size range: 0.04m x 0.04m – 0.10m x 0.12m), and patches of saltmarsh vegetation is taking hold. The inter-tidal zone increases in width to 28m along this section and is composed of silty-sand (30%/70% mix) with frequent gravel inclusions. Occasional large, sub-angular rocks, are dotted along its extent. A thick growth of *bladderwrack* seaweed covers the inter-tidal zone (approximately 80% coverage).

Reference Point 14, NGR: 826127E, 337211N (Plates 36-38, Figure 11): this section of foreshore is characterized by a 110m north-south x 205m east-west inlet where a tributary of the Bellanaboy River discharges into the bay. The upper foreshore is composed of rounded to sub-rounded cobbles, below which a 10m band of *bladderwrack* seaweed is located; along the HWM. The inter-tidal zone measures 110m in maximum with and is composed of water-sorted sediment deposition from the river discharge. The upper area of the inert-tidal zone is composed of a 40%/60% silt-sand mix. This sediment mix changes, with the silt content greatly increasing, the further north you travel across the foreshore. The greatest silt content being present along a 30m band above the LWM, 70% silt /30% sand mix. This deposit measures 2m+ in depth.

Reference Point 15, NGR: 82912E, 336995N (Plates 39-41, Figure 11): the foreshore is delineated by a shallow peat deposit (0.25m height) with an overlying cover of saltmarsh vegetation. The HWM is composed of sub-rounded gravels and small sub-rounded stones (>0.04m x 0.05m) overlying a silty-sand (30%/70%). This composition extends into the inter-tidal zone where it becomes extensively covered with *bladderwrack* seaweed. The inter-tidal zone is 31m in width at this location.

Reference Point 16, NGR: 835839E, 336647N (Plates 42-44, Figure 11): this section of foreshore is similar to that found at the previous reference point. The inter-tidal zone measuring 33m in width and is composed of sub-rounded gravels and small sub-rounded stones (>0.04m x 0.05m) overlying a silty-sand (30%/70%). *Bladderwrack* seaweed covers 70% of this zone.

Reference Point 17, NGR: 852022E, 335561N (Plates 45-47, Figures 11, 15): this section of foreshore is located 200m east of Foreshore Area 1, located within the townland of Aghoos. The foreshore is delineated by a shallow peat deposit (0.30m height) with an overlying cover of saltmarsh vegetation. The HWM is composed of sub-rounded gravels and small to medium sub-rounded stones (0.04m x 0.05m – 0.08m x 0.10m) overlying a silty-sand (30%/70%). This composition extends into the topmost section of the inter-tidal zone (10m wide section) where it becomes extensively covered with *bladderwrack* seaweed. The inter-tidal zone extends approximately 200m northward to reach the central flow-channel at the LWM. This zone is composed of a silty-sand (30%/70%) with frequent shell and gravel inclusions. Occasional stones/ rocks dot the inter-tidal zone, providing anchor points for *bladderwack* seaweed to take hold.

Reference Point 18, NGR: 855377E, 335513N (Plates 48-50, Figures 11, 15): this section of foreshore is located on the eastern limit of the section of foreshore identified as Area 1, located within the townland of Aghoos. The HWM is delineated by a shallow peat deposit (0.30m-0.40m height) with an overlying cover of saltmarsh vegetation. A large bank structure is located 0.5m behind (south) of the HWM. This bank comprises of a 2m+ high deposit of juvenile peat overlying a light grey/ brown deposit of silty-sand. As found at TRP17, the HWM is composed of sub-rounded gravels and small to medium sub-rounded stones (0.04m x 0.05m – 0.08m x 0.10m) overlying a deposit of silty-sand (30%/70%). This composition extends into the topmost section of the inter-tidal zone (10m-20m wide section) where it becomes extensively covered with *bladderwrack* seaweed. The inter-tidal zone extends approximately 80m northward to reach a southward meander in the central flow-channel running through Sruwaddacon Bay. This zone is composed of a silty-sand (30%/70%) with frequent shell and gravel inclusions. A 30m long feature extends northward from the HWM. This comprises of a natural deposit of small to medium, sub-rounded rocks, (0.25m x 0.30m – 0.35m-0.45m size range) that are randomly spaced approximately 1m-2m apart. *Bladderwrack* seaweed is extensively anchored to these rocks. This feature has been formed by natural estuarine processes, which have transported and deposited the rocks at this location. The feature or spit forms part of a series of similar features located along the foreshore at Aghoos.

Reference Point 19, NGR: 858153E, 335281N (Plates 51-53, Figure 11, 15): this section of foreshore is located along the foreshore at Aghoos, 80m east of Area 2 and 139m northwest of Area 3. The HWM is delineated by a shallow peat deposit (0.20m-0.30m height) with an overlying cover of saltmarsh vegetation. The HWM is composed of a mass of sub-angular rocks, largely uniform is size (measuring up to

0.06m x 0.08m in size). This rocky deposition extends below the HWM for a distance of 14m and is completely covered with *bladderwrack* seaweed. A silty-sand (30%/70% mix) forms the seabed along the LWM, which is located along the southern limit of the central-flow channel at this location.

Reference Point 20, NGR: 861885E, 335222N (Plates 54-56, Figures 11, 15): this section of foreshore is located at the eastern limit of Sruwaddacon Bay. It is delineated by a steep sided, undulating, peat deposit measuring 2.5m+ in height. Saltmarsh vegetation covers this deposit and extends 7-8m east towards the HWM. The HWM is composed of a mass of angular rocks, largely uniform is size (measuring between 0.04m x 0.05m and 0.06m x 0.06m). This rocky deposition extends below the HWM for a distance of 11-12m and is completely covered with *bladderwrack* seaweed. A silty-sand (30%/70% mix) forms the seabed along the LWM.

Observations

A number of modern objects were encountered during the survey and all represented modern, dumped debris. The majority of were located within the sandbank areas, and are believed to have been used as fastening points for mono-filament netting, and discarded mono-filament netting was found either attached to or located close by to these objects. Only two features of note were encountered during the survey:

Feature 1 comprises an artificial, linear, deposit of rocks located at NGR: 826197E, 337967N (Plate 57, Figure 11). The feature is aligned Northwest-Southeast and extends from the upper foreshore for a distance of 8m to end just below the HWM. The structure comprises of a single course of un-faced stone blocks; measuring on average 0.40m in length x 0.30m in width x 0.30m in depth. It is of dry-stone construction and no trace of mortar bonding was present. The structure is thought to represent a simple, nineteenth or early twentieth-century, boat-slip or landing place; suitable for a rowing boat, *curragh*, or similar size vessel.

Feature 2 comprises the upstanding remains of a nineteenth-century boathouse, located at NGR: 826143E, 33851N. (Plates 58-59, Figure 11). The boathouse is of roughly-coursed masonry construction, bonded with a coarse lime mortar. The structure is rectangular in form, running northeast to southwest for a distance of approximately 6m. Both the back wall (north side) and the eastern wall survive to a height of 1.25m, while the west and south walls survive to a maximum height of 2.75m. Collapsed masonry from the boathouse is located to the east and south of the structure. The boathouse is almost certainly associated with an adjacent, ruined, two-

storey house of nineteenth-century date; the boat house lying within its field boundary.

Conclusion

The inter-tidal assessment was comprehensive. No material/ deposits/ structures of archaeological significance were observed as part of the survey. While the presence of Features 1 (possible slipway) and 2 (ruined structure; boathouse) are of historic interest, providing an insight into the nineteenth-century and early twentieth century use of the foreshore, they hold no inherent archaeological value.

The inter-tidal zone was largely clear of man-made surface debris; only occasional modern debris being found across the foreshore and sandbank areas. Given the compact and rocky topography which makes up much of the upper foreshore area, a poor archaeological holding-content can be ascribed. Together with a lack of any physical evidence from the survey, this has resulted in poor archaeological potential. A medium archaeological holding-content can be ascribed to the inter-tidal sandbank areas. While they lie within a high-energy environment, one that would move any portable objects downstream, the sandbank areas provide a good holding-content for larger, non-portable, objects or structural remains; these would be quickly buried within the shifting sands of the bank structure. As such, the possibility that archaeological material/deposits may lie buried *in-situ* within the sandbank areas remains.

5.2 Sub-tidal Zone

Seabed Topography

The sub-tidal zone is limited to the central-flow channel which meanders westwards between a series of large sandbanks (Figures 11-12). This central flow-channel measures 30-40m along much of its extent, reaching a maximum width of 140m between Reference Points 8 and 11. However, even at its widest point the channel is split into two sections, measuring 54m and 63m in width, with an intersecting 23m wide sandbank. A water depth of between 0.30-0.40m was recorded for the shallowest parts of the channel, increasing to a maximum depth of 2m along the deepest parts.

The seabed between NGR: 860114E, 335228N and NGR: 850980E, 336158N (located across eastern quarter of bay) is composed of a silt-sand mix (30%/70% mix) with occasional cobble inclusions. It is flat and featureless with occasional scouring around, water-rolled, peat deposits or larger rocks. The silt content present within the seabed decreases as you travel west across the bay; the silt being replaced by coarser sediments and crushed shell deposits. The seabed between NGR: 860114E, 335228N and NGR: 825003E, 337942N (the central half of the bay) is composed of a silt-sand (5%/95%) mix and remains largely flat and featureless. This bottom topography changes between NGR: 860114E, 335228N and NGR: 822782E, 338993N where water velocity is greatly increased and deep scour holes (1m+ in depth) are present. The natural bedrock is being exposed within the deeper scour holes. The seabed is composed of a coarse sand deposit, with frequent crushed shell, overlying a rocky bottom.

Observations

Only one man-made object was encountered as part of the underwater survey, located at NGR: 841635E, 336978N (Figure 9). The object represents a mass of iron measuring 3m (north-south) and 0.40m (east-west). The object is modern in origin and is believed to a machine part.

Magnetometer Survey

Magnetometer survey by hand-held metal-detector was undertaken across two areas, as identified in Figure 12. Metal-detection (MD) Area 1 is located at the eastern limit of Sruwaddacon Bay (Reference Point 20) and MD Area 2 represents a large sand bank located on the northern side of the bay (Reference Point 6).

A medium-low target ratio of 1 hit per 2m² was encountered across MD Area 1. The majority (90%) of the targets represented sub-surface hits. Surface finds included: fragments of barbed wire fencing, fishing weights/ hooks, drinks cans, etc. All material encountered was of modern origin.

A medium-low target ratio of per 2m² was encountered across the upper foreshore at MD Area 2. In contrast, a relatively low target ratio of 1 hit per 3-4m² was encountered across the inter-tidal sandbank area. As with Area 1, targets were mainly sub-surface. Surface hits included machine parts, a car wheel, and fragments from a metal drum. All material encountered was of modern origin.

5.3 Foreshore Areas of Archaeological Potential

The foreshore surrounding Sruwaddacon Bay is considered an area of archaeological potential. The foreshore locations at Aghoos Td. and Glengad Td. which are located next to the proposed temporary construction sites for the proposed pipeline tunnelling works are discussed further in this section. Three areas of archaeological potential have been identified on the foreshore/ intertidal zone at Aghoos Td., Foreshore Areas 1-3, and one at Glengad Td., Foreshore Area 4 (Figures 13-16).

ID	Foreshore Area 1
Figures/Plates:	Figures 13-15, Plates 60-66
Legal status	None, area of archaeological potential
Townland	Aghoos
Location:	155m north-east of Starting Pit, NGR: 852689E, 336430N
Extent:	This area encompasses both the upper foreshore and inter-tidal zone, stretching across a 264m (east-west) x 175m (north-south) area.

Topography

The upper foreshore ranges between 12m-16m in width across this area and is composed of a thin (>0.10m), grass-covered (*Saltmarsh* grass), deposit of peat with frequent rounded and sub-rounded stones (<0.10m x 0.10m). This area of foreshore is delineated by a 0.30m high deposit of silty-sand (fine-coarse sediments), light brown in colour, with frequent coarse gravel and rounded to sub-rounded stone inclusions. This deposit lies beneath a 1.5m-2m deposit of raised peat-bog, covered by hawthorn, tufted sedge-grass, and mixed heather species (Plates 60-61). Frequent tree stumps and trunk sections are visible within the peat matrix (Plates 62-63). In addition a series of tree stumps are also located within the intertidal zone (Plate 64). The inter-tidal zone measures 148m in width at Low Water and comprises of a silty-

sand (30%/70% mix) with frequent shell and small stone inclusions. A series of three natural features of seaweed covered rocks extend northward from the foreshore across Area 1 (Plates 65-66). These features are formed from angular and sub-angular rocks that are covered with *bladderwrack* seaweed. The rocks are randomly deposited and are loosely spaced (*c.*1m-2m apart).

Archaeological Assessment

The field inspection was comprehensive and extended across the area as identified in Figure 13. The presence of tree stumps along the foreshore indicate the presence of an ancient shoreline that was *c.*40m further north than that of the present day. No archaeologically or historically significant material, structures, or deposits were encountered as part of the survey. In addition, there was no visible change in foreshore exposure levels from that observed in the previous survey at this location.

ID	**Foreshore Area 2**
Figures/Plates:	Figures 13, 15, Plates 67-69
Legal status	None, area of archaeological potential
Townland	Aghoos
Location:	Temporary shore Access Point, NGR: 852689E, 336430N
Extent:	This area encompasses both the upper foreshore and inter-tidal zone, stretching across a 200m (NW-SE) x 95m (SW-NE) area.

Topography

The upper foreshore ranges between 10m-17m in width across this area and is composed of a thin (>0.10m), grass-covered (*Saltmarsh* grass), deposit of peat with frequent rounded and sub-rounded stones (<0.10m x 0.10m). The foreshore is delineated by a 0.20m high deposit of silty-sand (fine-coarse sediments), light brown in colour, with frequent coarse gravel and rounded to sub-rounded stone inclusions. The deposit lies beneath a 1.5m-2m deposit of raised peat-bog, covered by hawthorn, tufted sedge-grass, and mixed heather species (Plate 67). The inter-tidal zone measures 30m in width at Low Water and comprises of a silty-sand (30%/70% mix) with frequent shell and small stone inclusions. Two natural features comprising of seaweed covered rocks extend northward from the foreshore across Area 2 (Plates 68). These linear features are composed of angular to sub-angular rocks covered with *bladderwrack* seaweed. These rocks have been randomly deposited and are loosely spaced (*c.*1m-2m apart).

Archaeological Assessment

The field inspection was comprehensive and extended across the area as identified in Figure 13. No archaeologically or historically significant material, structures, or deposits were encountered as part of the survey. In addition, there was no visible change in foreshore exposure levels from that observed in the previous survey at this location. The only man-made feature located within this area is a field-boundary fence which extends from the upper foreshore and across the inter-tidal zone for a distance of 29m to reach the LWM (Plate 69). This modern feature corresponds with anomaly SS29 from the side-scan sonar survey undertaken within Sruwaddacon Bay.

ID	**Foreshore Area 3**
Figures/Plates:	Figure 13, 15, Plates 70-72
Legal status	None, area of archaeological potential
Townland	Aghoos & Bellagelly South
Location:	Watercourse (*Lenamore River*) crossing point located east of temporary construction compound, NGR: 824565E, 338303N
Extent:	This area encompasses a 40m (east-west) x 100m (north-south) section of estuarine foreshore located in south-eastern corner of Sruwaddacon Bay.

Topography

Area 3 comprises of an inlet located at the discharge point of a small waterway (Lenamore river), situated at the south-eastern limit of Sruwaddacon Bay. The southern half of Area 3 is composed of water-cut peat deposits (0.75m height) with an overlying growth of mixed-grass species (Plate 70). The watercourse meanders in a northerly direction through this area. It is predominantly shallow with an average water-depth of 0.10m, although occasional sections reach a maximum depth of 0.30m (Plate 71). The streambed is compact and composed of rounded to sub-rounded stones (>0.06m x 0.08m) and pebbles (>0.02 x 0.03m). A shore access trackway is located on either side of the stream at this location. The northern half of Area 3 is inter-tidal in nature and a band of seaweed (*bladderwrack*) covers a 43m section of the zone, extending from the HWM (Plate 72). The inter-tidal zone extends 170m from the HWM to the LWM, located adjacent to the bay's central-flow channel. The inter-tidal zone is composed of a silty-sand (40%/60%) with frequent gravel and small stone inclusion. The silt content within this deposit is believed to be higher than observed for other areas of foreshore within the bay due to the discharge of silt from Lenamore river.

Archaeological Assessment

The field inspection was comprehensive and extended across the area as identified in Figure 13. No archaeologically or historically significant material, structures, or deposits were encountered as part of the survey, and there was no visible change in foreshore exposure levels observed in the 2007 survey at this location.

ID	**Foreshore Area 4**
Figures/Plates:	Figure 14, 16, Plates 27-28, 73
Legal status	None, area of archaeological potential
Townland	Glengad
Location:	178m east of Reception Pit, NGR: 820834E, 338476N
Extent:	This areas encompasses both the upper foreshore and inter-tidal zone, stretching across 244m (east-west) x 119m (north-south)

Topography

The survey area is located on the south-eastern limit of a large sand bank and sand dune system located on the southern side of the mouth of Sruwaddacon Bay. This area is composed of a silty-sand (40%/60% mix) with frequent stone and crushed shell inclusions (approximately 30%). The silt content is increased because of the deposition of river sediments along the eastern extent of the sand bank; the sediments are washed downstream through the central-flow channel from the Glenamoy and Muingabo Rivers. In addition, it was noted that because of the river deposition, several deposits within the sand bank comprise of 60% silt content with frequent tree branch and waterborne debris, including clumps of peat and other organic matter. Large sand dunes are located along the western limit of this area. A shallow watercourse is located at NGR: 820852E, 338466N, situated 10m to the south of the proposed pipeline route (Plate 73).

Archaeological Assessment

The field inspection was comprehensive and extended across the area as identified in Figure 14. No archaeologically or historically significant material, structures, or deposits were encountered as part of the survey. In addition, there was no visible change in foreshore exposure levels to those observed in the 2007 survey at this location.

Conclusion

No surface material, deposits, or structures, of archaeological/ historical significance were encountered as part of the non-disturbance survey at Foreshore Areas 1-4. The

possibility nevertheless remains that buried, *in situ*, archaeological features could be present at these locations.

5.4 Geophysical Anomalies

A list of geophysical anomalies was identified in advance of dive work in Sruwaddacon Bay, and their details are set out below in Appendix 1 (Figure 17). In only one instance (Anomaly 20) did the geophysical data suggest that the anomaly retained clear archaeological significance. However, as this feature and several other of the anomalies lay outside Sruwaddacon Bay itself they were also outside the dive inspection zone, which was restricted to the Sruwaddacon Bay. Such 'external' anomalies were not considered further. Dive inspection of the anomalies within the bay used the location coordinates to position over the feature. A measured line search around the feature was undertaken to assess fully the anomaly and its immediate context.

Conclusion

All side-scan sonar anomalies located were of natural of modern origin. Anomalies SS1, SS3, SS4, SS6, SS8, SS10, SS13, and SS26 were identified during the underwater survey, these anomalies being located within the sub-tidal zone (Plates 74-76). The remainder of the anomalies were located within the inter-tidal zone and were easily identified during the foreshore and sandbank walk-over.

6.0 POTENTIAL IMPACTS[5]

Potential Impacts during Construction Phase

A tunnel will be constructed beneath Sruwaddacon Bay, a method designed to minimise seabed and foreshore disturbances. This method requires the excavation of a starting pit at Aghoos Td. (NGR: 855759E, 335374N) and a reception pit at Glengad Td. (NGR: 819098E, 338559N). These works represent potentially significant impact on the existing environment, from an archaeological perspective. The main tunnelling work will be conducted at a minimum depth of 5.5m below surface and represent an imperceptible impact on the known archaeological environment. If an intervention pit in the Bay is required, this would represent a potentially significant impact on the existing environment, from an archaeological perspective. Surface intervention would require a shaft to be excavated from the seabed surface to the obstruction located at the TBM head. This intervention shaft/

[5] This section does not purport to relate precise engineering details but is rather an attempt to understand the nature of the impact on the potential archaeological environment, based on the data supplied by RPS.

pit would require sheet piling prior to excavation of the seabed material. In addition, the use of an intervention pit may result in a secondary impact to the foreshore at Aghoos; a shore access point being required to mobilise and embark the excavation machinery. A temporary access point has been designated for this purpose snd designed to mitigate any impact to the foreshore. It is located across a 138m section of foreshore, adjacent to the Aghoos construction site, at NGR: 856778E, 335391N (centre-point).

A linear section of intertidal zone will be impacted by the construction of the pipeline between the Starting Pit (Aghoos Td.) and the Gas Terminal (Bellanaboy Td.). This section of pipeline will cross a small inlet located at the south-eastern corner of Sruwaddacon Bay, at NGR: 85880E, 335061N (centre-point). A small watercourse discharges (Leenamore River) into the bay at this location. An open trench construction method will be used to construct the pipeline at this location.

Potential Impacts during Operational Phase

As no surface archaeological indicators were encountered as part of the archaeological assessment of the inter-tidal foreshore and underwater areas impacted by the proposed pipeline crossing within Sruwaddacon Bay, it is anticipated that any impact to archaeological features would take place during the site preparation or construction stage of the proposed pipeline development; thus all archaeology will be resolved prior to the operational phase of the site.

Impacts during Decommissioning Phase

There will be no impact on archaeological or cultural heritage during the decommissioning stage of the project as it is anticipated that all archaeological features and sites will be resolved in the preconstruction or construction stage of the proposed development.

7.0 CONCLUSION

The conclusion of this assessment is that the known archaeological potential within Sruwaddacon Bay is low. This assessment does not extend on land beyond the foreshore but it is understood that the landward side of the pipeline route retains archaeological potential, as detailed separately by Margaret Gowen Ltd (see Appendix N). The possibility remains that the subsurface deposits within the Bay retain archaeological material. The mobile nature of the estuarine silts within the sandbank areas and the palaeo-channel on the south side of the bay in particular would be an ideal holding area for such material. This is especially the case for all-wooden constructions, such as log boats and other pre-modern sailing craft and

related features, since geophysical prospecting is unable to detect such anomalies that are buried. This point was made in the course of the Irish Subsea 2025 Gas Interconnector project at the Gormanston, Co. Meath landfall, when a 7m long logboat was encountered during dredging 1km offshore.[6] Despite detailed geophysical survey in advance of the work, it was impossible for the suite of instruments to detect the wooden vessel. It is therefore recommended that all ground disturbances, on land and at sea, are archaeologically monitored, with the proviso to resolve fully any archaeological material observed.

8.0 RECOMMENDATIONS

Pre-construction Measures

No further archaeological measures are deemed necessary in advance of construction works commencing.

Construction Phase Measures

ARCHAEOLOGICAL MONITORING. It is recommended that archaeological monitoring licensed by the Department of the Environment, Heritage and Local Government is conducted during all seabed and inter-tidal/foreshore disturbances associated with the development. Licence applications take a minimum of three weeks to process through the Department, and advance planning is required to ensure that the necessary permits are in place before site works commence.

Monitoring of the extracted spoil material from the tunnelling process is recommended. A programme of monitoring is to be carried out for all tunnelling works. This programme will be reviewed once the works are underway.

Should an intervention pit be required, it is recommended that any associated seabed disturbances are archaeologically monitored, with the proviso to resolve fully archaeologically significant materials that may be observed at that point.

RETAINING AN ARCHAEOLOGIST/S. An archaeologist experienced in maritime archaeology will be retained for the duration of the relevant works.

[6] Niall Brady, Archaeological Monitoring and Excavation. Gas 2025 Irish Subsea Interconnector Gormanston Landfall, Co. Meath, 02E0467, 02E0948, Interim Report, The Archaeological Diving Company Ltd, 27 November 2002; Reported by Niall Brady in Eoin Grogan, Lorna O'Donnell and Penny Johnston, *The Bronze Age Landscapes of the Pipeline to the West* (Dublin 2007), pp 325-6.

THE TIME SCALE for the construction phase will be made available to the archaeologist, with information on where and when ground disturbances will take place.

DISCOVERY OF ARCHAEOLOGICAL MATERIAL. In the event of archaeologically significant features or material being uncovered during the construction phase, machine work should cease in the immediate area to allow the archaeologist/s to inspect any such material.

ARCHAEOLOGICAL MATERIAL. Once the presence of archaeologically significant material is established, full archaeological recording of such material is recommended. If it is not possible for the construction works to avoid the material, full excavation would be recommended. The extent and duration of excavation would be a matter for discussion between the client and the licensing authorities.

ARCHAEOLOGICAL TEAM. It is recommended that the core of a suitable archaeological team be on standby to deal with any such rescue excavation. This would be complimented in the event of a full excavation.

ARCHAEOLOGICAL DIVE TEAM. It is recommended that an archaeological dive team is retained for the duration of any inwater disturbance works on the basis of a twenty-four or forty-eight hour call-out response schedule, to deal with any archaeologically significant potential material that is identified in the course of the ground disturbance activities. The permits necessary for this aspect of the site work are additional to the excavation licence required by the archaeological monitor, and are generally held by the dive-team leader. The archaeological dive licence takes a minimum of 3-5 weeks to process. It is necessary to ensure that all permits are in place before site works commence.

A SITE Office and facilities should be provided on site for use by archaeologists.

BOUYING/FENCING of any such areas would be necessary if discovered and during excavation.

MACHINERY TRAFFIC during construction will be restricted to avoid any identified archaeological site/s and their environs.

SPOIL will not be dumped on any of the selected sites or their environs.

PLEASE NOTE: The above recommendations have been outlined and discussed with the National Monuments Section at the Department of the Environment, Heritage and Local Government.

Operational Phase Measures

It is not anticipated that any archaeological measures should be necessary during the operational phase.

Decommissioning Phase Measures

It is not anticipated that any archaeological measures should be necessary in during the decommissioning phase.

Residual Impacts

There will be no residual impacts on archaeological features or sites encountered as it is understood that any archaeology encountered will be resolved in the construction stage of the proposed pipeline development.

9.0 ACKNOWLEDGEMENTS

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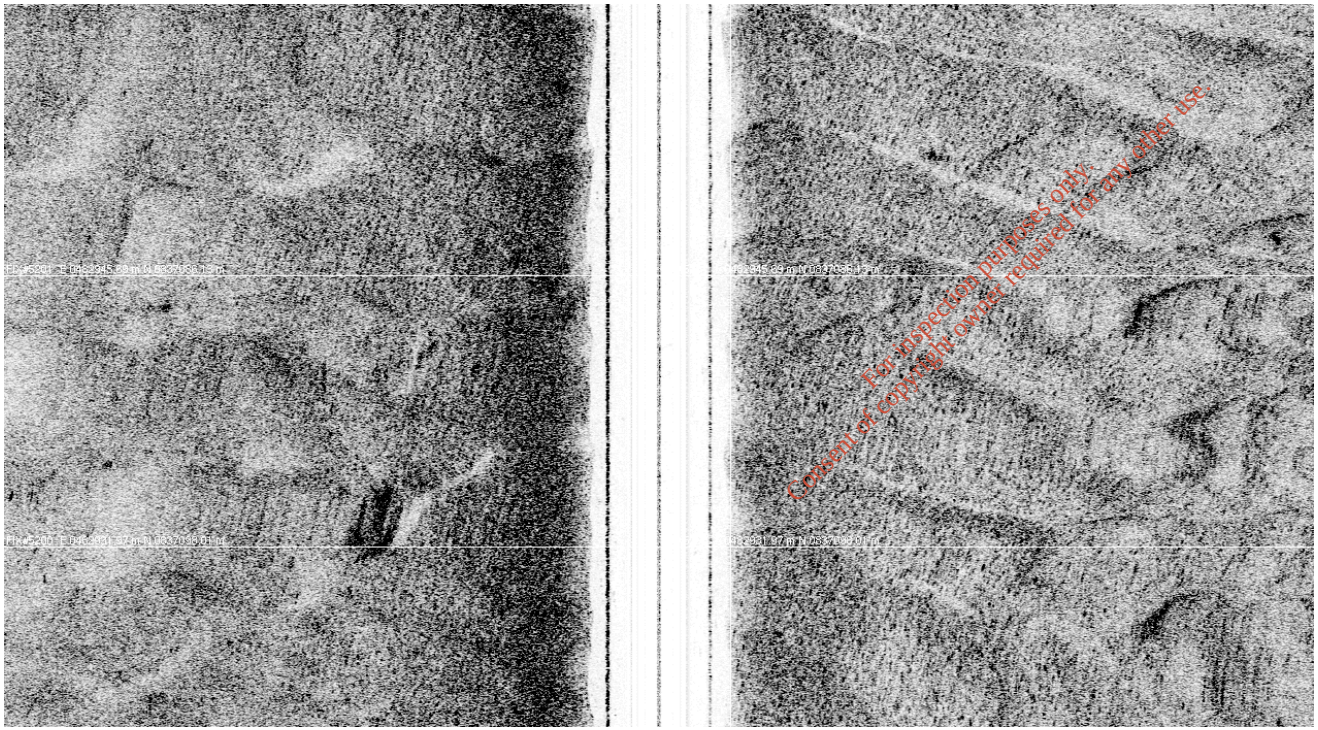
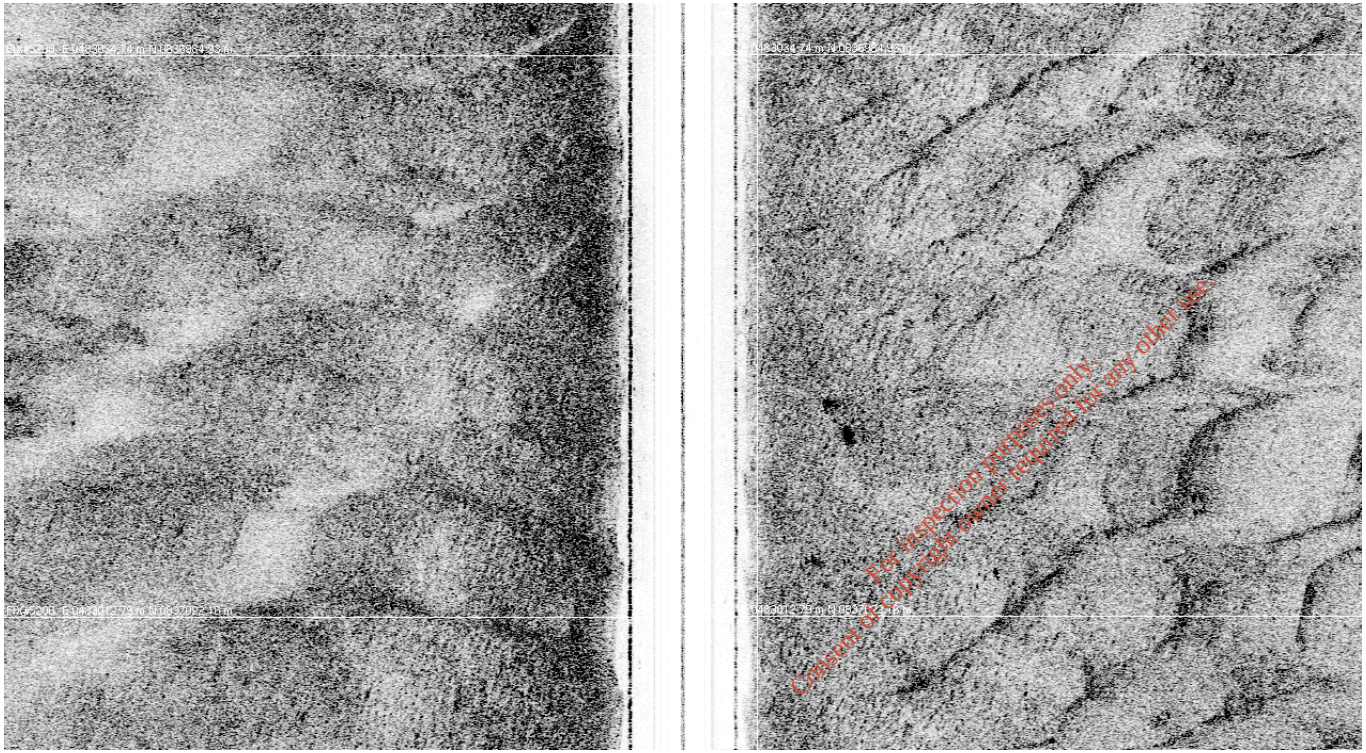
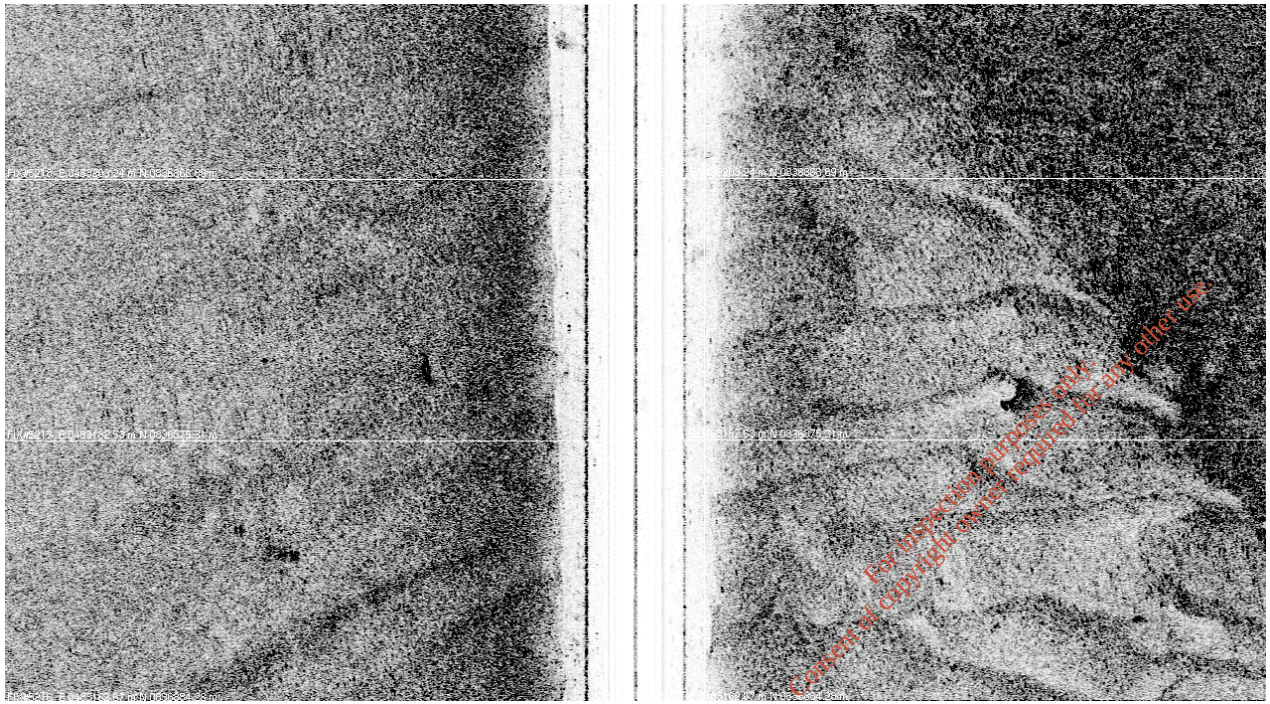
APPENDIX 1
Table of Side-scan Sonar anomalies Identified

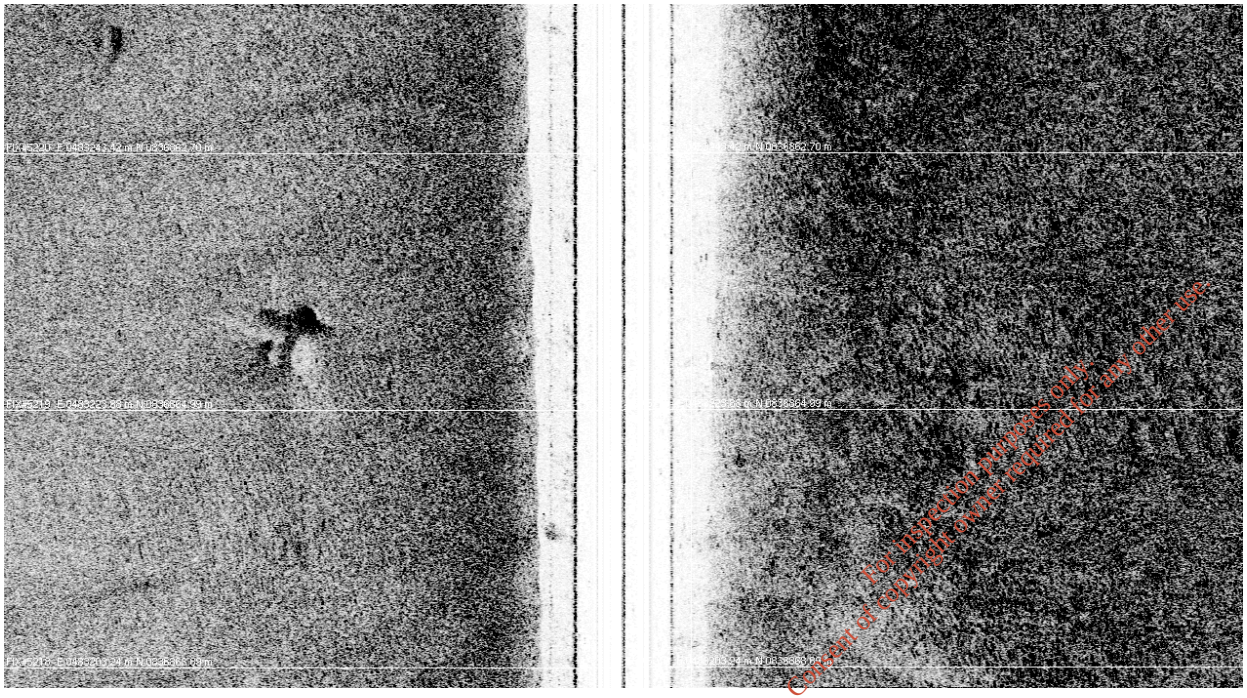
Appendix 1: Table of Side-scan Sonar Anomalies Identified, Sruwaddacon Bay

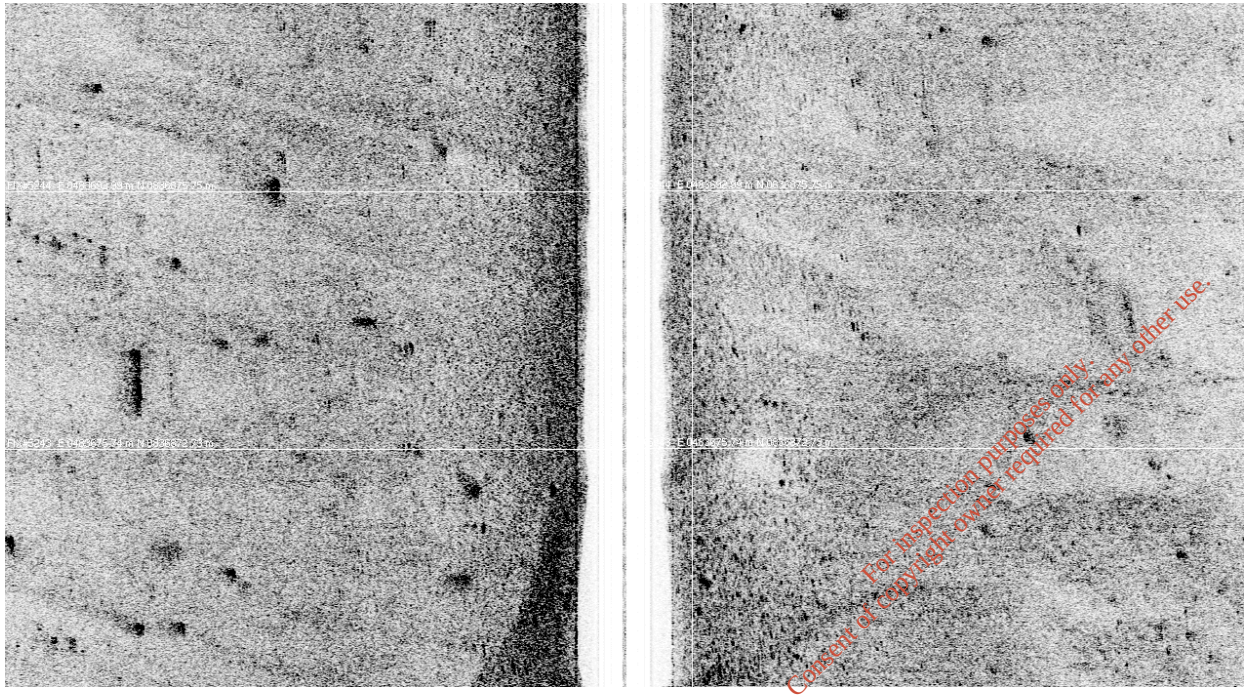
Note: Lat/Long shown as WGS84 degrees, decimal minutes

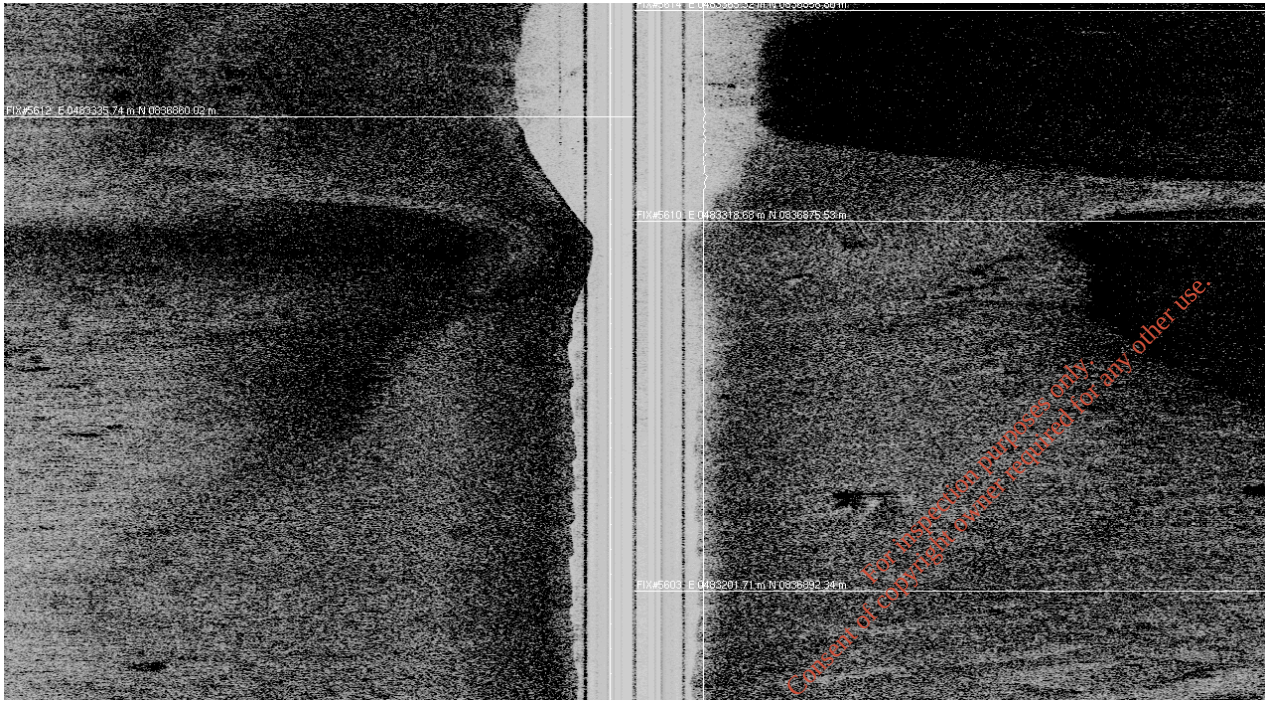
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
1	5200	482941.72	837103.25	82965.268	337097.893	54	16	9.57458	9	47	49.62708	Small anomaly less than 1m long on area of mudflat waves
												**Diver Inspection Identification:** Kelp anchored to large rock
2	5206	483014.93	837008.39	83038.494	337003.013	54	16	6.56783	9	47	45.44971	Localized small-scale anomaly. Debris or peat

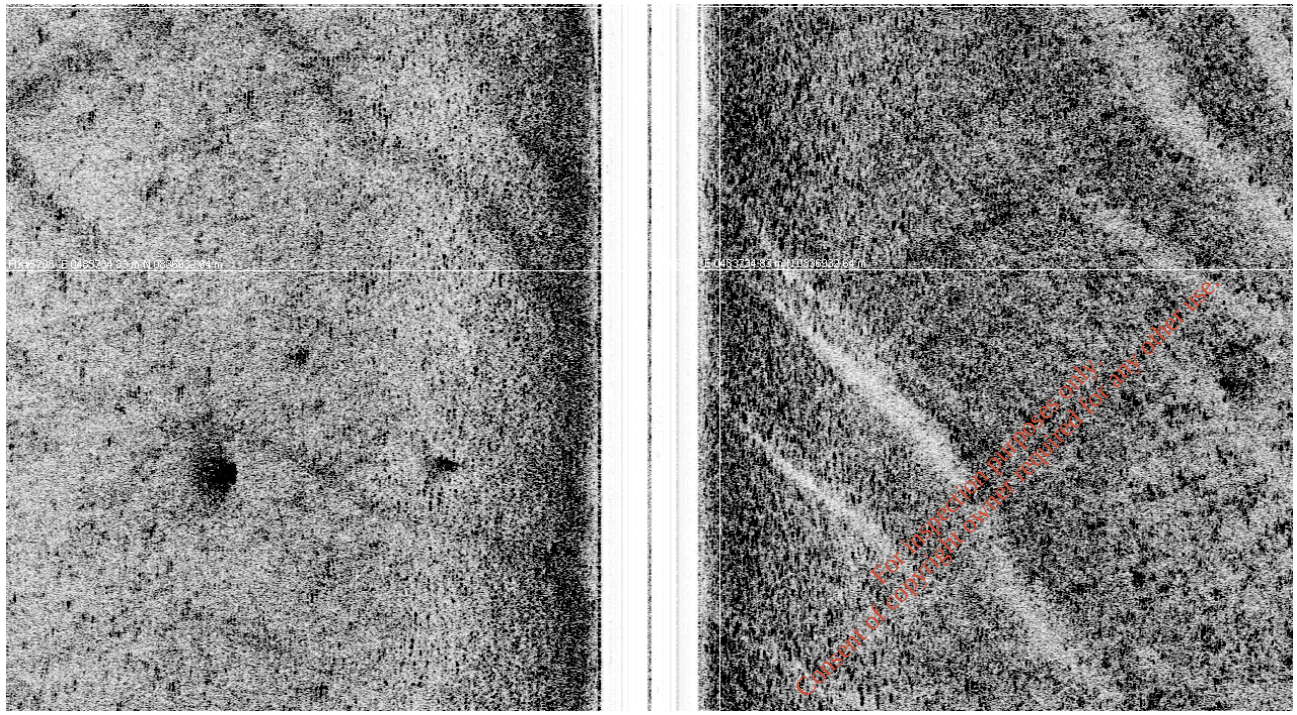
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N		WGS84 Long W				Description
												**Diver Inspection Identification:** Lump of water-rolled Peat
3	5217	483179.42	836859.12	83203.021	336853.71	54	16	1.87689	9	47	36.15415	Hemispherical shaped anomaly, small scale, debris. Less than 1m in diameter

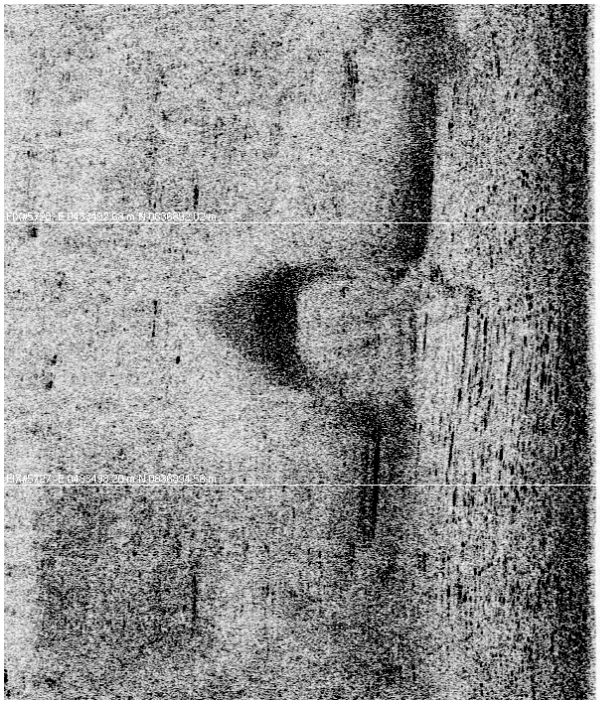
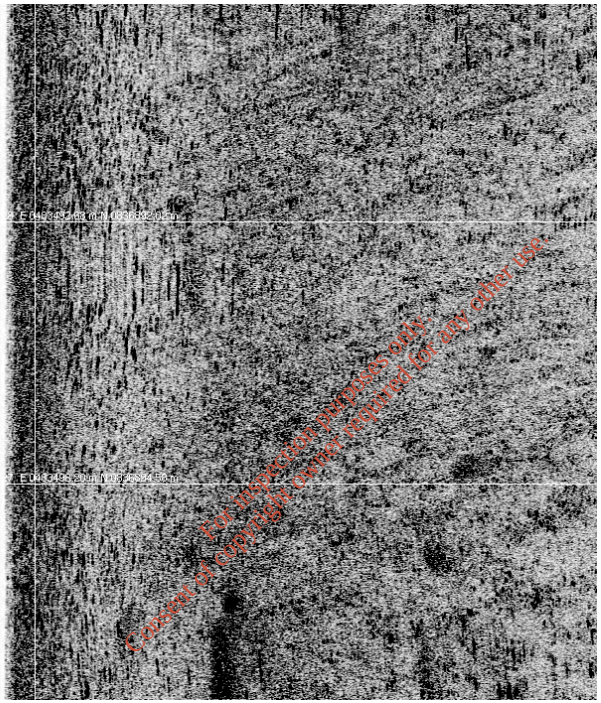
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N		WGS84 Long W			Description
											**Diver Inspection Identification:** Car wheel
4	5283-4	483226.69	836878.66	83250.3	336873.255	54	16	2.5475	9	47	33.57058	Irregularly shaped anomaly occupying c. 2m square area in sandy/muddy environment

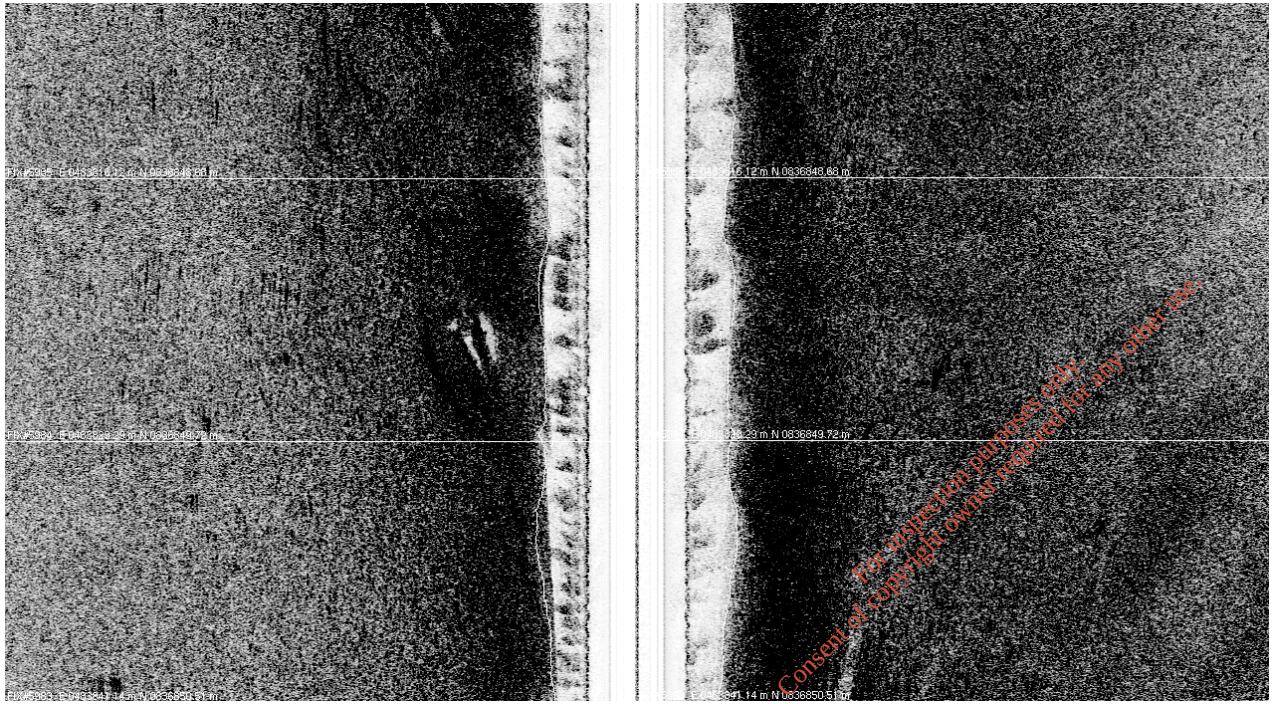
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
												**Diver Inspection Identification:** Kelp anchored to large rock.
6	5244	483675.67	836894.46	83699.376	336889.058	54	16	3.42645	9	47	8.79279	2m long linear anomaly on silt bed. Debris/pipe piece

Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
												**Diver Inspection Identification:** Tree branch debris
7		485128.35	836422.67	85152.368	336417.167		15	49.3535		45	47.89993	6m long narrow irregular feature, possibly a ridge/outcrop of peat in a muddy bottom
												Diver Inspection Identification: Tree branch debris
8	5606	483228.6	836877.71	83252.211	336872.304	54	16	2.51835	9	47	33.46375	c. 6m long object partly buried in silt/mud with scour pockets either side. Probable debris

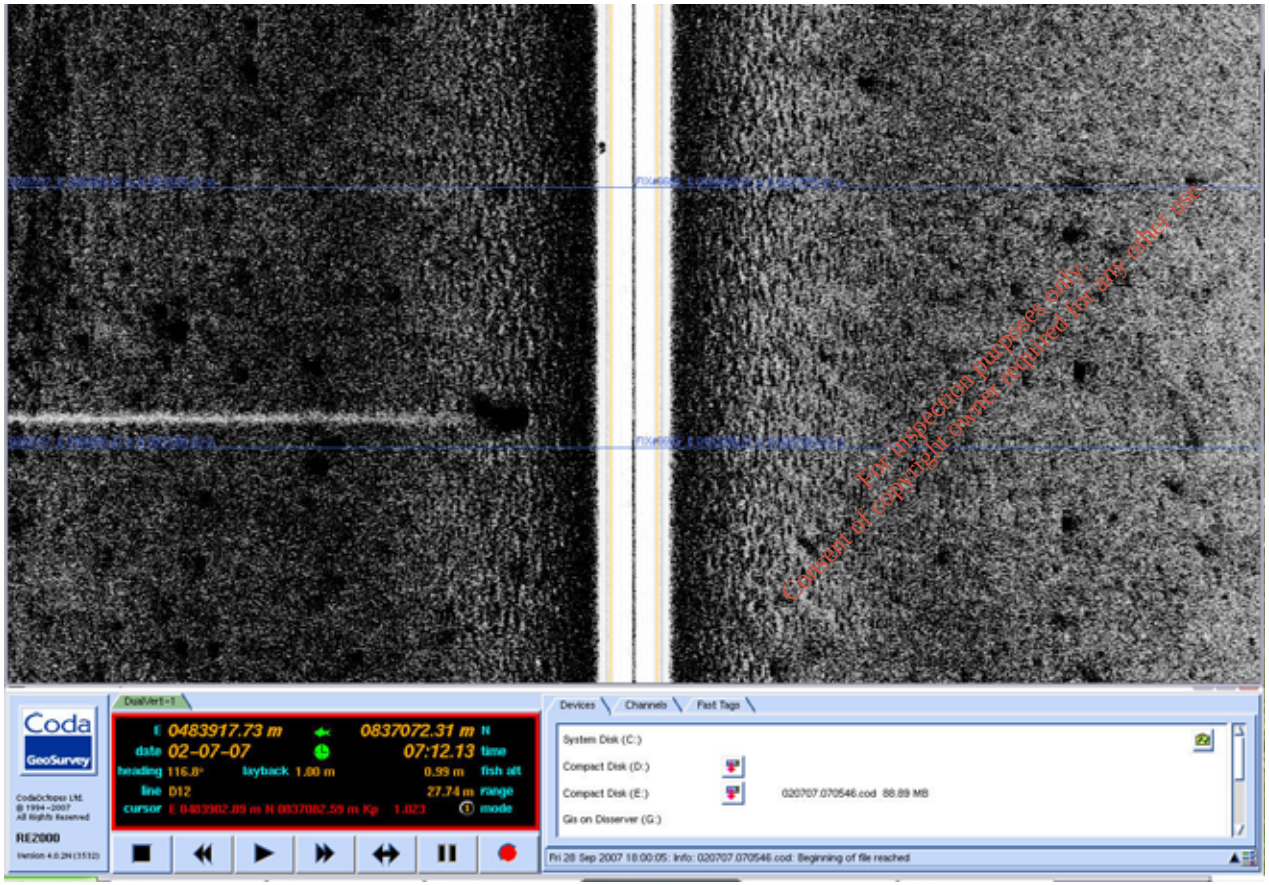
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
												**Diver Inspection Identification:** Kelp anchored to large rock; Same as SS4.
9	5708	483745.57	836916.4	83769.29	336911.003	54	16	4.193	9	47	4.96242	Short defined anomaly rising clear of the seabed. Debris or turf clod

Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N		WGS84 Long W				Description
												**Diver Inspection Identification:** Large Lump of water-rolled Peat
10	5727	483499.03	836879.44	83522.698	336874.035	54	16	2.79617	9	47	18.52871	Probable natural feature, forming bow-shaped extrusion from a linear ridge-like area

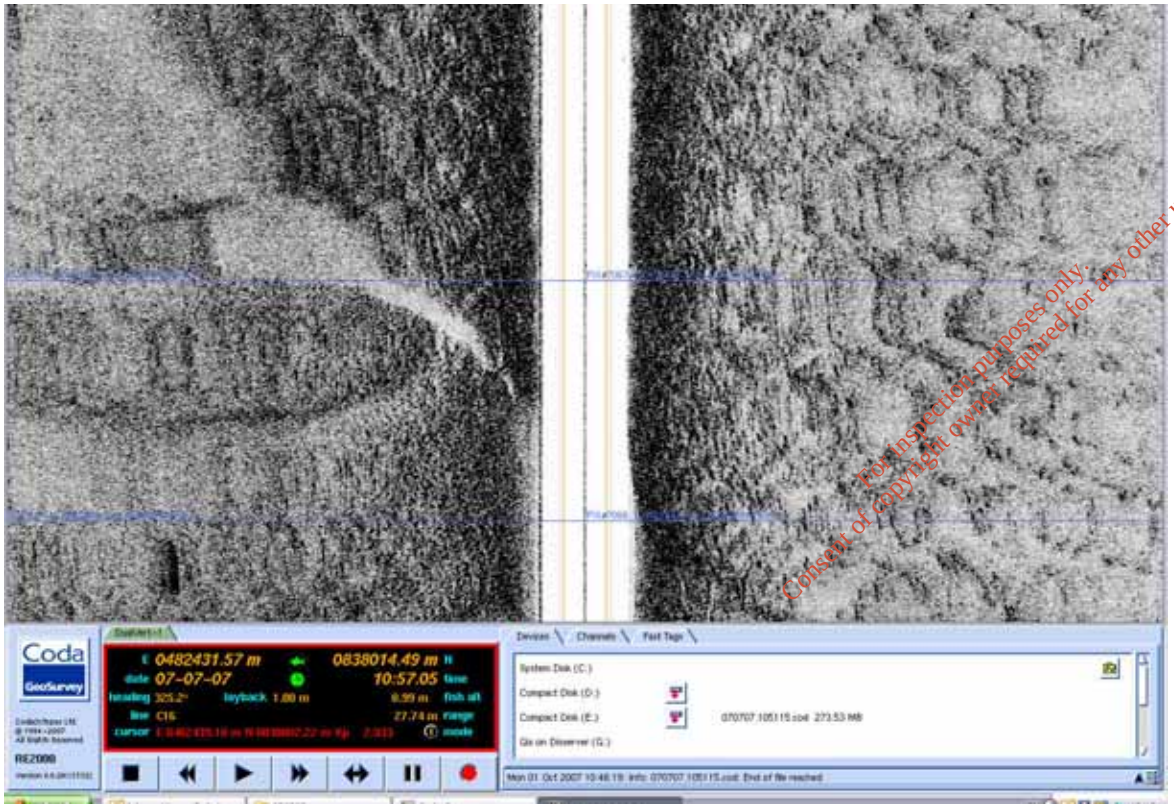
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
												of the seabed
 												**Diver Inspection Identification:** Scour hole around large rock
11	5985	483823.78	836843.65	83847.517	336838.237	54	16	1.90477	9	47	0.54078	3-4m long irregularity in muddy seabed area, indicative of partly buried feature, perhaps debris

Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N	WGS84 Long W	Description
								**Diver Inspection Identification:** No anomaly encountered during diver-truhting of SS11.

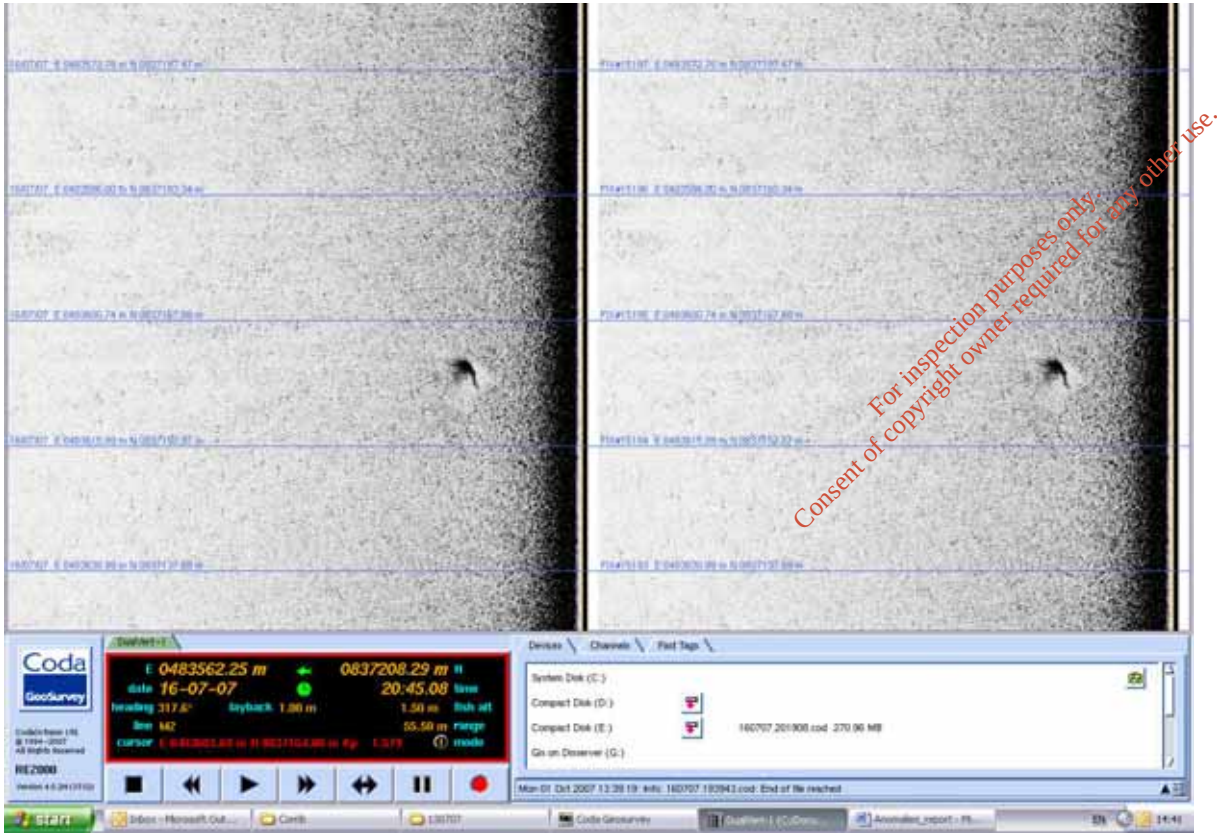
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N	WGS84 Long W	Description

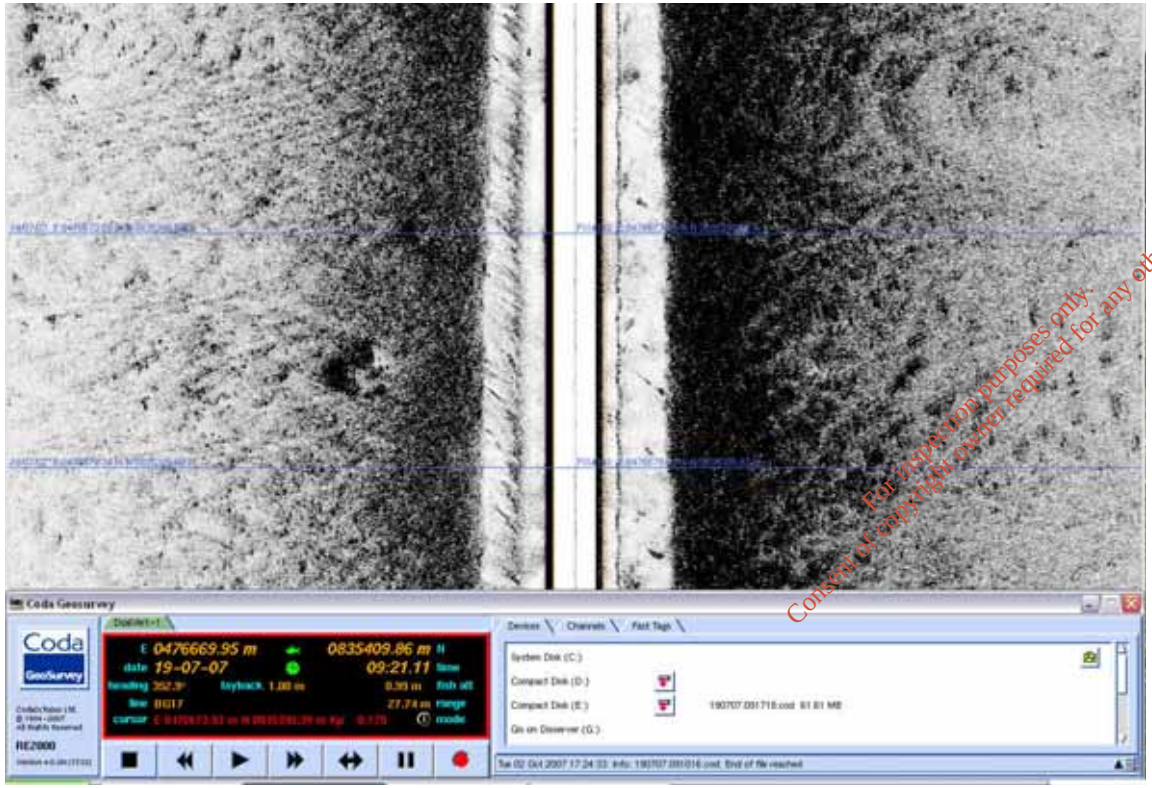
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
12	6665	483898.69	837088.32	83922.441	337082.961	54	16	9.8767	9	46	56.74445	Sharply defined anomaly with strong echo indicative of rising above seabed; probable pole
												**Diver Inspection Identification:** Seaweed covered Breeze-Block and small scour hole, Plate 50.

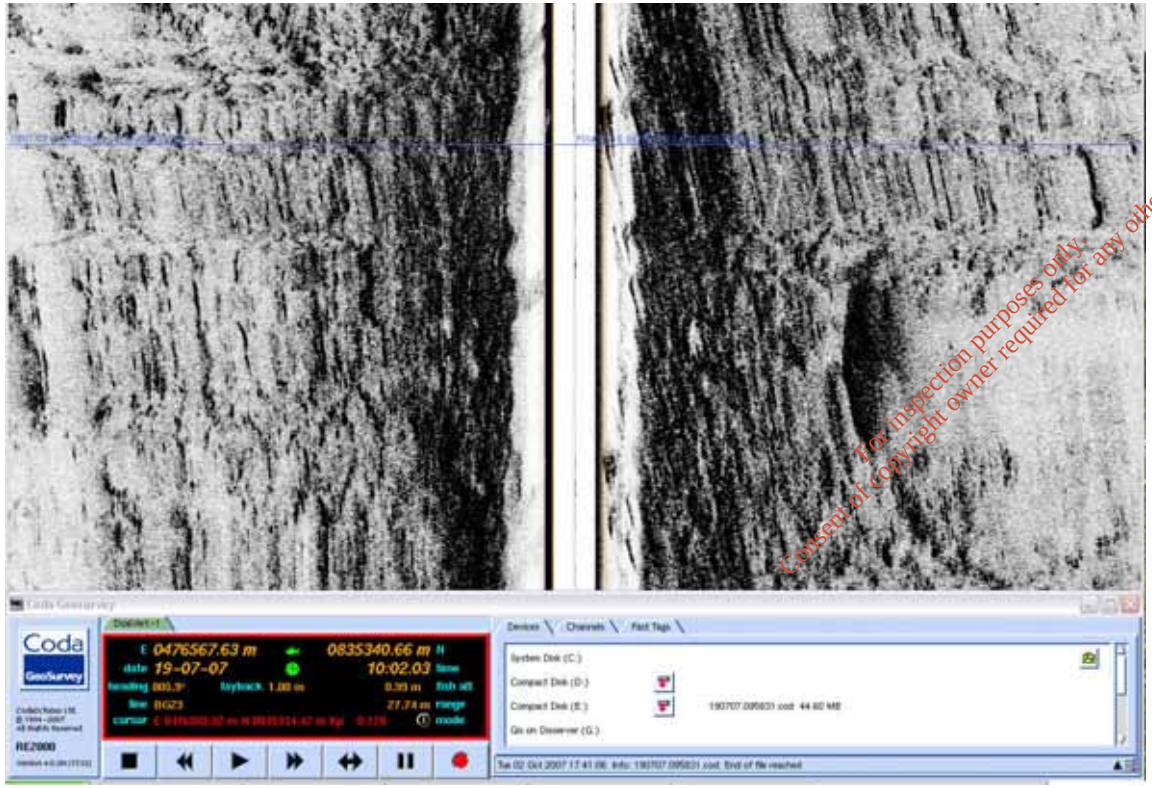
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
13	7066-7	482435.28	837997.53	82458.712	337992.368	54	16	38.0703	9	48	18.86582	Localized anomaly that presents a bow-shaped scour pattern in SW direction

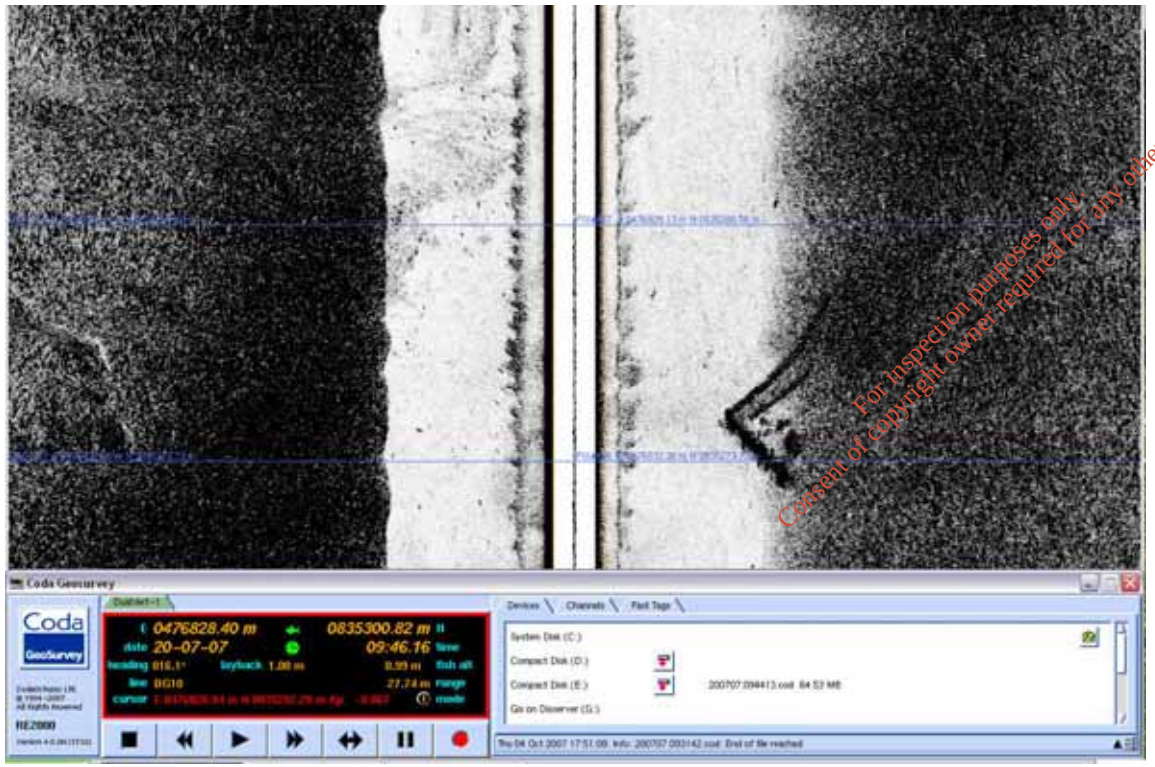


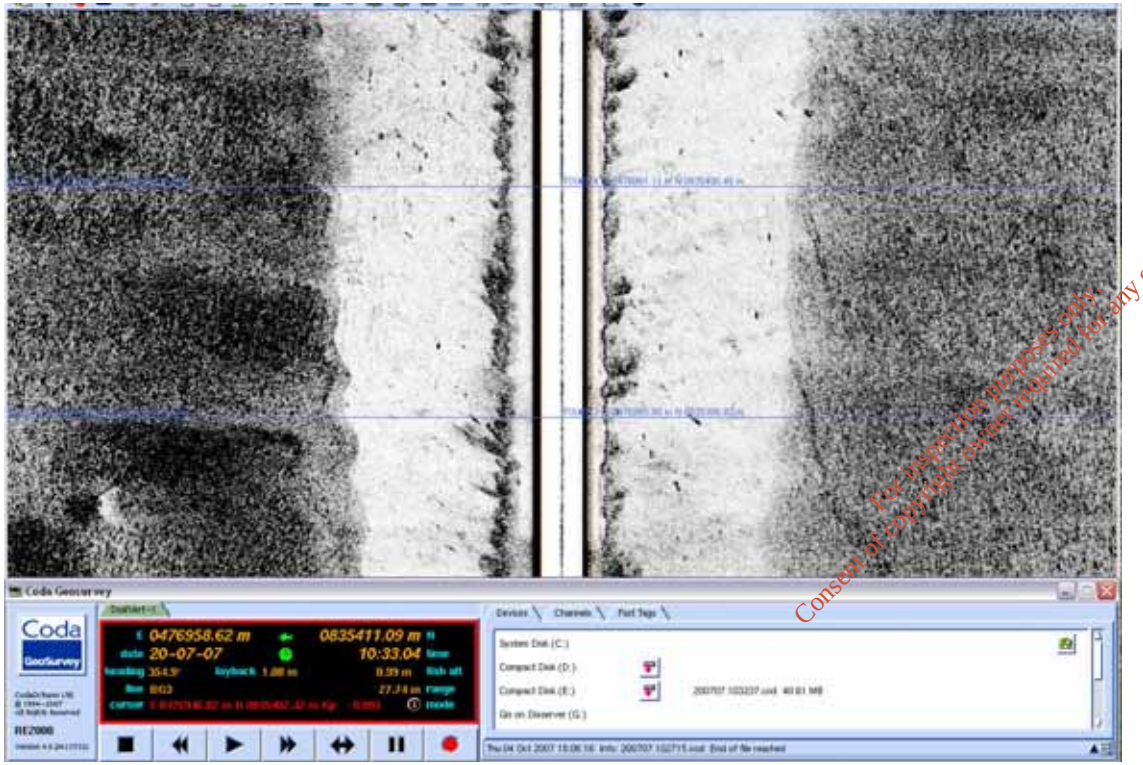
Diver Inspection Identification: Scour-hole with small rocks at its base.

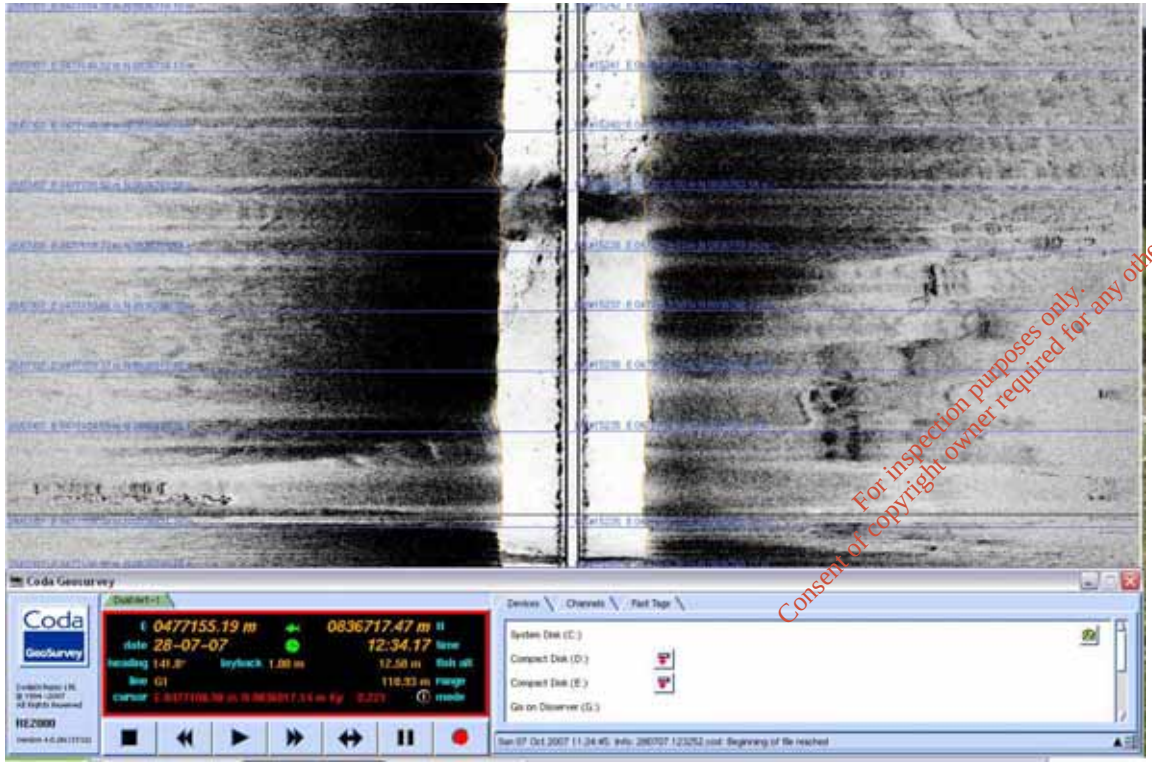
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
16	14873	483594.07	837159.93	83617.756	337154.586	54	16	11.9429	9	47	13.67148	Localized small anomaly on seabed, debris
See anomaly 17, which is the same location												
17	15194	483597.76	837154.03	83621.447	337148.685	54	16	11.7551	9	47	13.45939	Localised anomaly on sandy featureless bed. Debris
												**Diver Inspection Identification:** Anomalies 16 and 17 are the same object observed from different angles. The object is a large Fragment of Iron, machine part, with scour hole and snagged mono-filament netting, Plate 51.

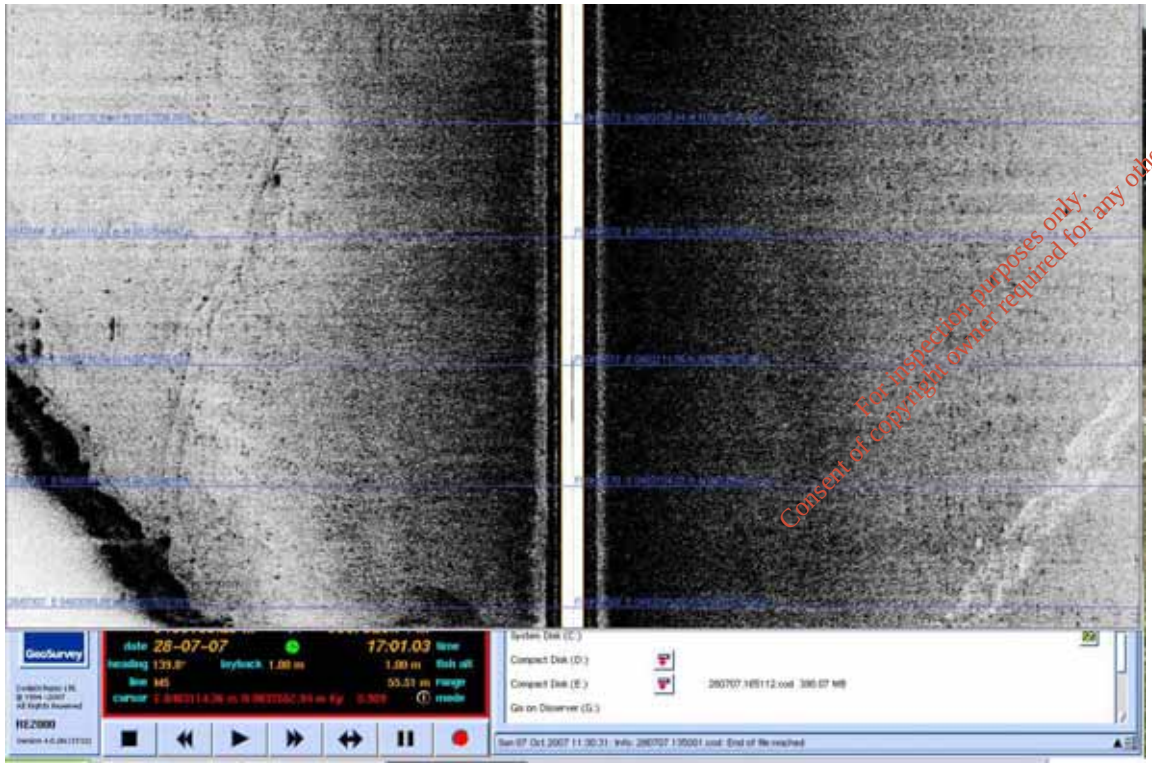
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
18	141?	476666.64	835388.59	76688.876	335382.857	54	15	8.83324	9	53	33.69643	Localized anomaly on rough silt bed. Rock?
												**Diver Inspection Identification:** Outside Study area

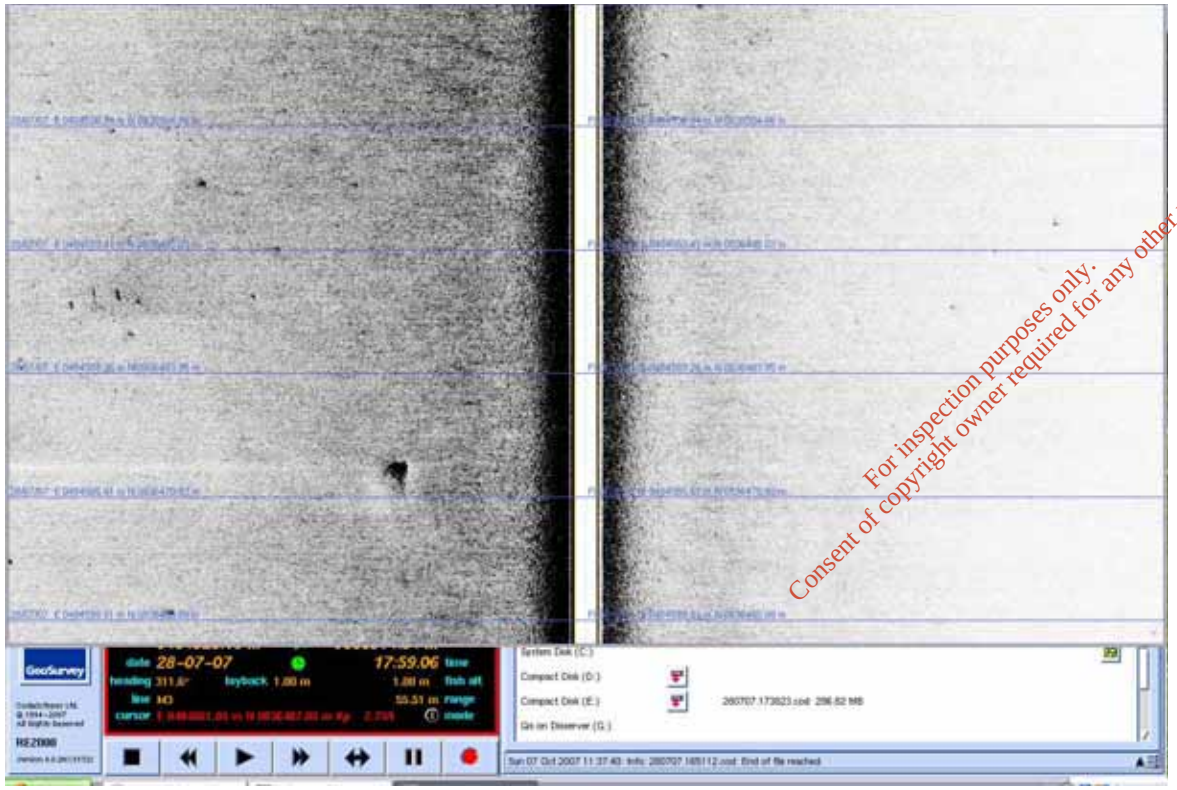
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
19	316?	476581.67	835333.19	76603.888	335327.445	54	15	6.96844	9	53	38.30577	linear straight-sided anomaly, c. 2m long x 70cm wide, possible plank like feature but equally possible turf-cutting anomaly
												**Diver Inspection Identification:** Outside Study area

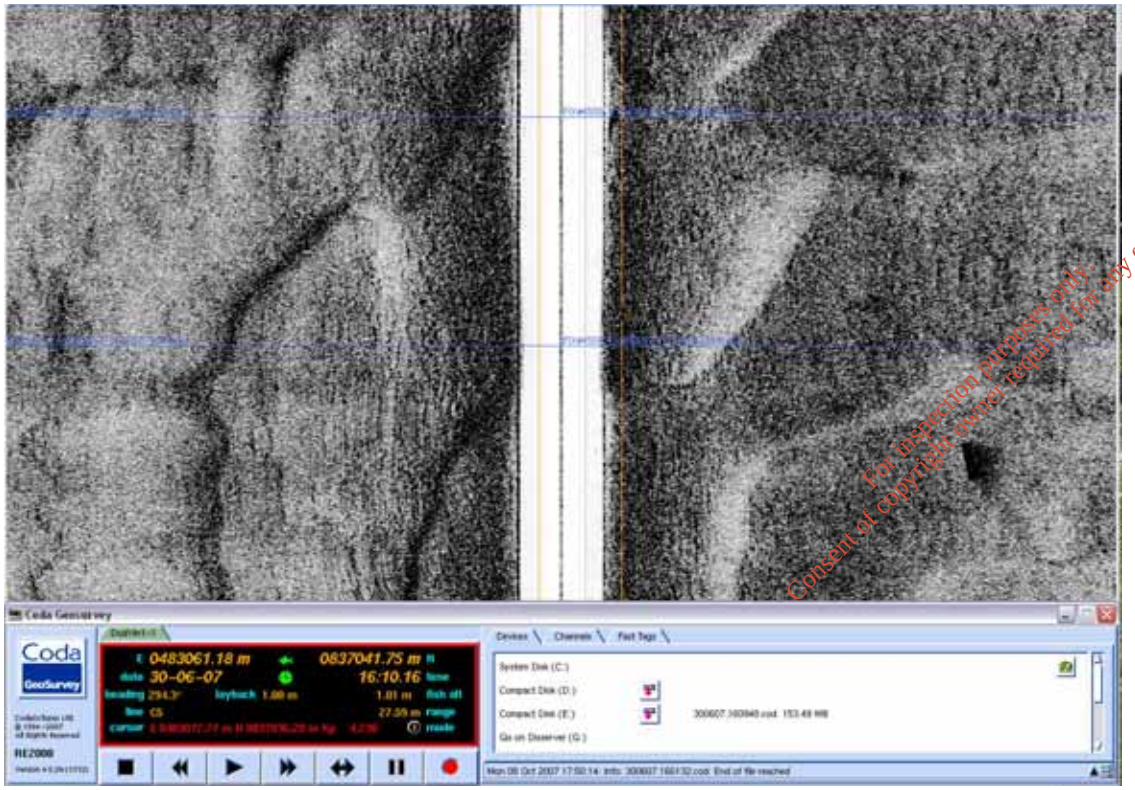
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
20	**406?**	**476839.59**	**835277.99**	**76861.864**	**335272.233**	54	15	**5.40736**	9	53	**23.98381**	**Striking anomaly on clay bed. Straight side 5.64m long with three curving ribs extending on SW side, the longest measuring 8.46m long. Definite high potential**
												**Diver Inspection Identification:** Anomalies located outside survey area, near Ballyglass Lighthouse.

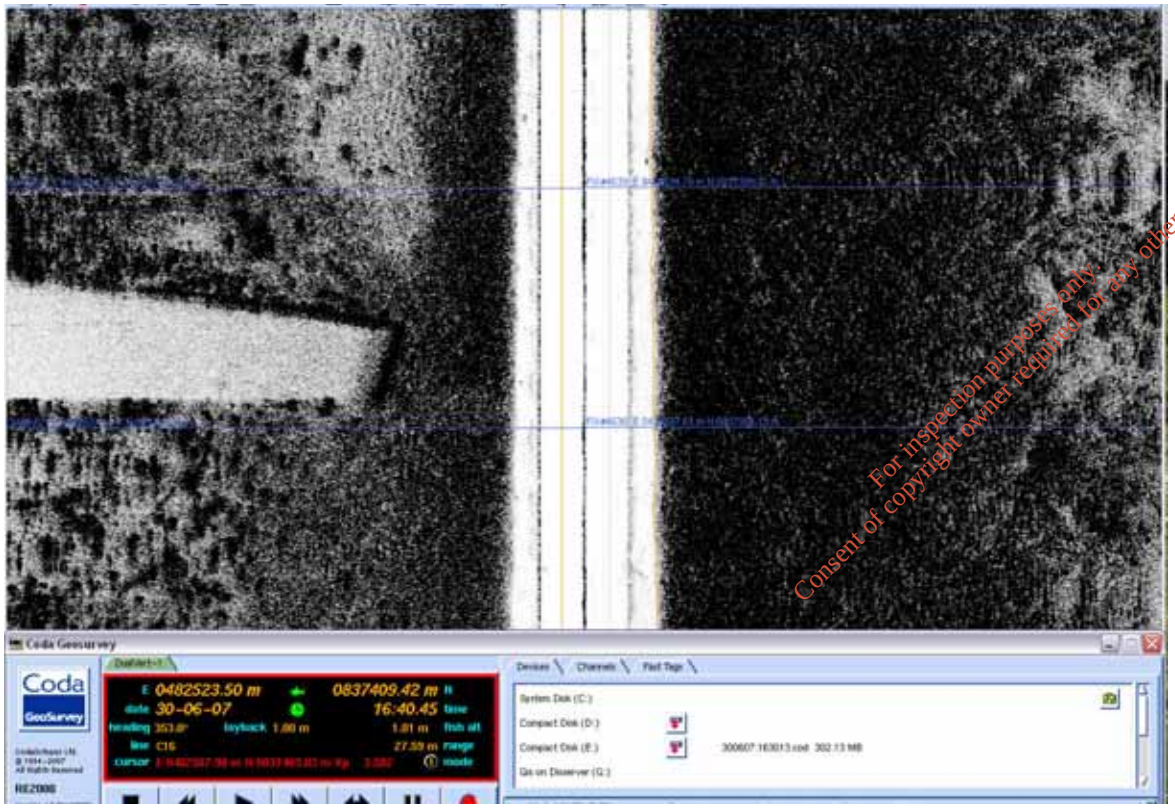
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
21	673	476946.42	835371.81	76968.715	335366.074	54	15	8.53306	9	53	18.22416	Localized anomaly on clay/sand bed. Debris?
												**Diver Inspection Identification:** Anomalies located outside survey area, near Ballyglass Lighthouse.

Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
22	15237	477108.51	836765.39	77130.826	336759.958	54	15	53.7283	9	53	11.3317	3m long anomaly on sandy bed
												**Diver Inspection Identification:** Anomalies located outside survey area, near Ballyglass Lighthouse

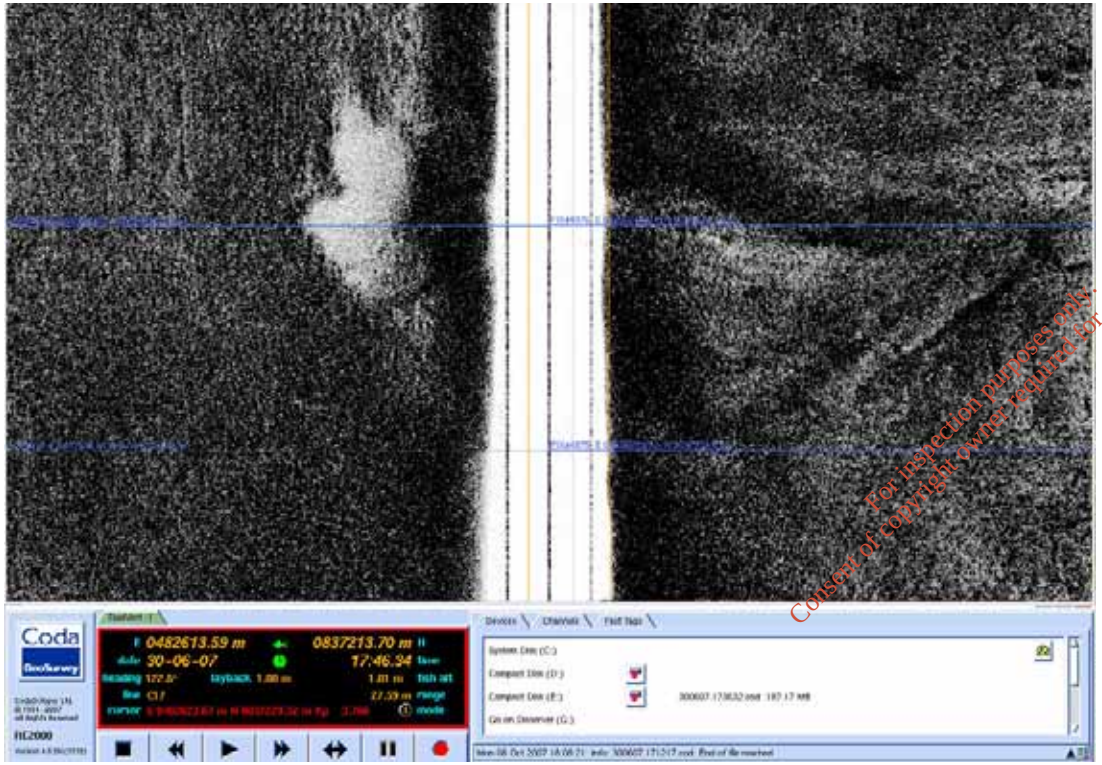
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
23	5569	483135.45	837590.55	83159.034	337585.299	54	16	25.4894	9	47	39.6103	Parallel linear track, probable dragline. Heading SE/NW from shore, c.40m long+, 1m wide.
	to 5573	483150.04	837550.34	83173.628	337545.081	54	16	24.2013	9	47	38.74779	
												**Diver Inspection Identification:** Anomalies located outside survey area, near Ballyglass Lighthouse.

Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
24	15___	484569.26	836461.46	84593.159	336455.965	54	15	50.1549	9	46	18.83318	Localized anomaly on area of clear sand. Debris?
												**Diver Inspection Identification:** No anomaly present. It is suggested that this might have been a portable object, perhaps a lump of peat that moved between the time of the geophysical survey and the dive inspection.

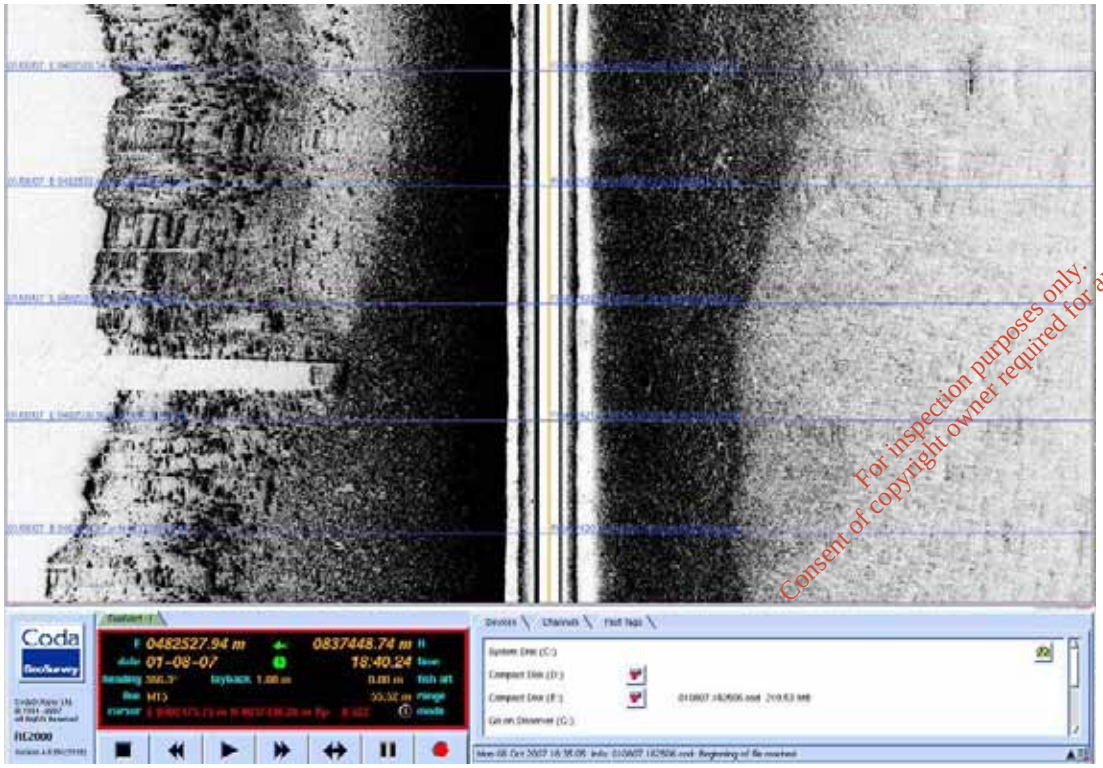
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
25	4504	483087.75	837049.47	83111.329	337044.102	54	16	7.95594	9	47	41.48505	c. 1m long narrow anomaly on sand-wave bed. Debris.
												**Diver Inspection Identification:** Dog Hutch within large scour hole, Plate 52.

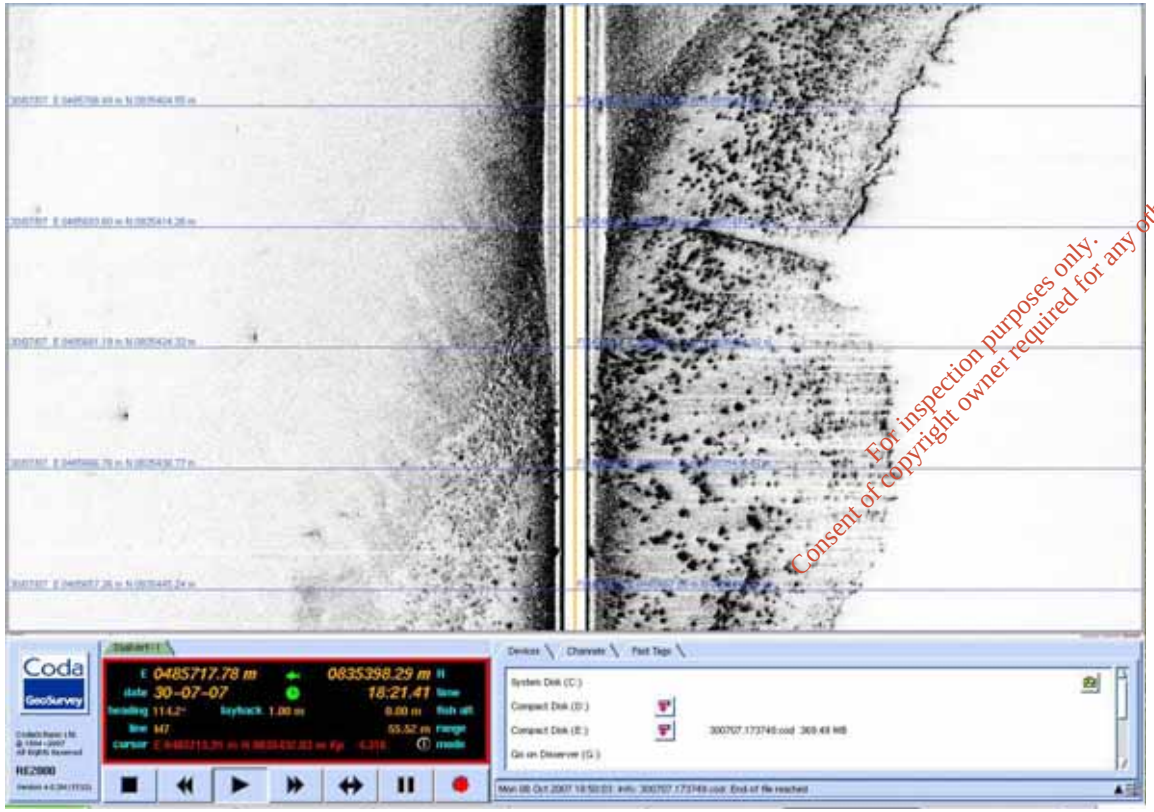
Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
26	4638	482537.61	0837884.13	82561.065	337878.943	54	16	34.48853	9	48	13.05203	Flat sharply defined anomaly with trapezoidal echo, centreline is 7m long.
												**Diver Inspection Identification:** No anomaly encountered during the diver-truthing of SS26.

Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
27	4975-6	482585.67	837217.93	82609.141	337212.598	54	16	12.9888	9	48	9.45649	Oblong anomaly on sand, probably natural.



Diver Inspection Identification: Natural ridge of stones.

Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
28	17421	482515.07	837386.17	82538.525	337380.875	54	16	18.3699	9	48	13.59398	Trapezoidal shaped anomaly with echo on silt/peat interface; manmade.
												**Diver Inspection Identification:** Pier Structure.

Anomaly No.	Fix No.	ITM Easting	ITM Northing	ING E	ING N	WGS84 Lat N			WGS84 Long W			Description
29	6__28	485680.46	835403.24	85704.605	335397.516	54	15	16.8375	9	45	16.0059	Straight narrow line leading off shore in area of peat (?) clods; service/water pipe? 15m long.
												**Diver Inspection Identification:** Modern Fence-line.