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Pre-installation ROV survey of proposed  
development site in Falls of Warness  
test area, May 2010

**Survey Report**

Prepared by Aquatera on behalf of Voith Hydro

P330 – May 2010

This study was completed for:

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# 1 Introduction

A ROV survey was undertaken to collect video footage of the seabed in the vicinity of the proposed installation site for a prototype tidal energy device. The video provides an indication of the seabed habitat and topography present in the area prior to the commencement of development activities at the site. The output will build on existing information held by EMEC and be used to support environmental and geotechnical assessments of the area.

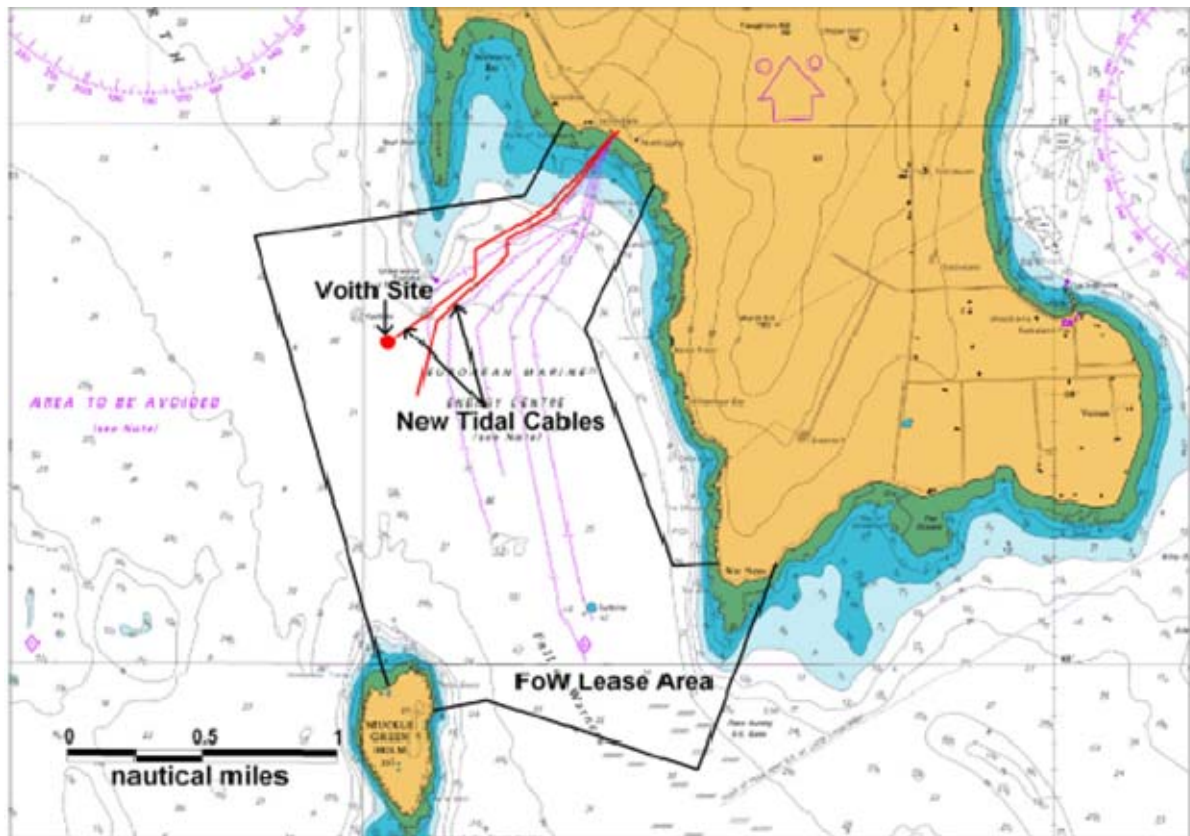
## 2 Survey Operations

### 2.1 Survey location

Survey operations took place in the northwest sector of EMEC's test site (see Figure 1.1). The coordinates of the proposed installation deployment site are:

59°09'11.54N, 02°49'49.65W (ETRS89)

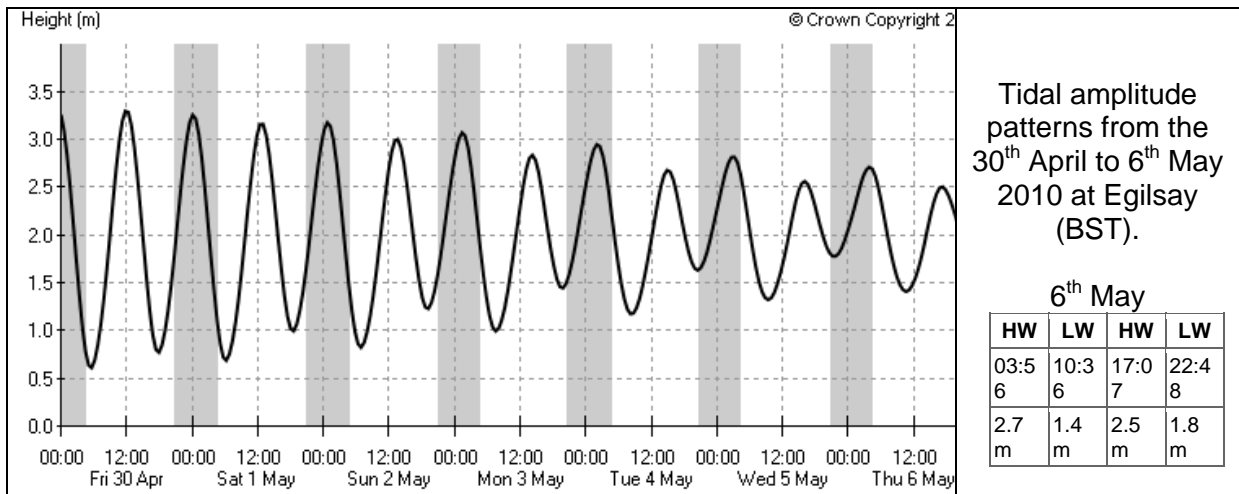
**Figure 2.1 Survey Location**



### 2.2 Survey timing

The survey was mobilised from Kirkwall on Thursday 6th May 2010. The timing of the survey was selected to correspond with the neap phase of the tidal cycle when tidal currents would be expected to be at a minimum at the site. Observation class ROVs can only be safely deployed in currents of less than approximately 1.5 knots (less than 1 m/s). The extreme tidal regime found in the test area means that deployments must take place at times of slack water (during changes in tidal direction). At this site, only a relatively short time-window for ROV work is available - in the order of 20 to 40 minutes (dependent upon prevailing weather conditions and tidal cycle). Figure 2.2 provides tidal data for the site during the time of the survey.

**Figure 2.2 Tidal amplitude at Falls of Warness site**



### 2.3 Survey vessel and equipment

- The survey vessel – *MV Guide*
- ROV system – *Seaeye Falcon*
- *EasyTrak* USBL system

Further details of the equipment used for the survey are provided in Section 4.

### 2.4 Survey Personnel

The vessel crew included the skipper, an umbilical man for the ROV, the ROV pilot and a USBL operator. A marine scientist was present in a survey coordinator role to coordinate the survey activity, observe the live footage and to guide the ROV pilot to any notable physical/ecological features.

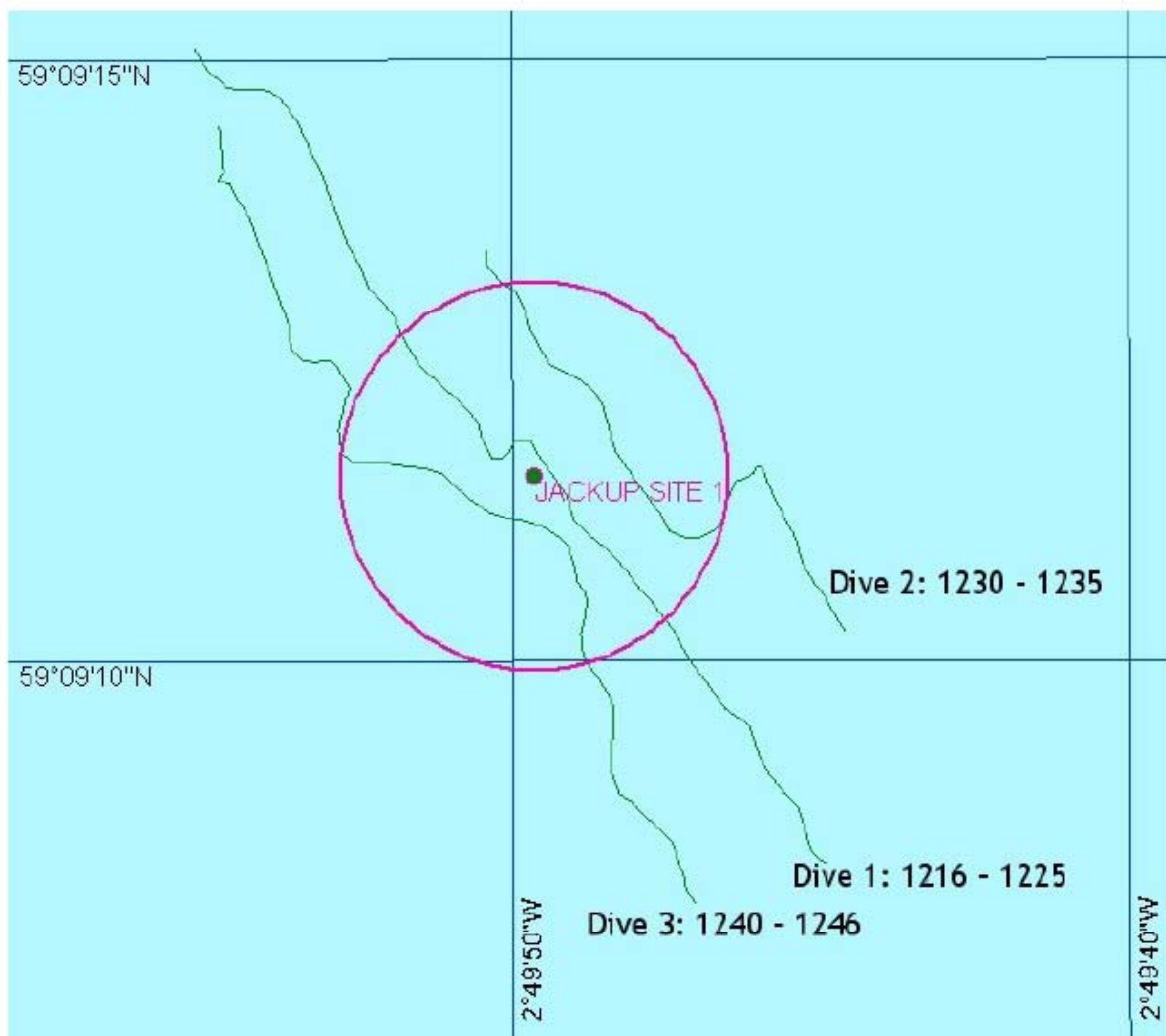
|                            |   |
|----------------------------|---|
| Skipper                    | Keith Bichan (RovingEye Enterprises)    |
| ROV Pilot                  | David Stevenson (RovingEye Enterprises) |
| Navigation/position fixing | Tris Thorne (Triscom)                   |
| Marine Scientist           | David Runciman (Aquatara)               |

### 2.5 Survey protocol

A USBL (ultra short baseline sonar) position fixing system was used to accurately monitor the location of the ROV during operations and the geographical coordinates were overlaid over the video footage. The ROV was flown over the seabed at a suitable height to provide a general overview of the seabed characteristics. The transit of the ROV was paused to obtain steady shots of any interesting seabed features, habitats or species encountered along the survey transects.

Three ROV deployments were undertaken during the period of slack water between 1215 and 1245 on 6 May. A graphical plot of the transects run on 6 May 2010 is provided in Figure 2.3. Survey operations were terminated at 1245 due to deterioration in weather conditions – increasing winds and wave height.

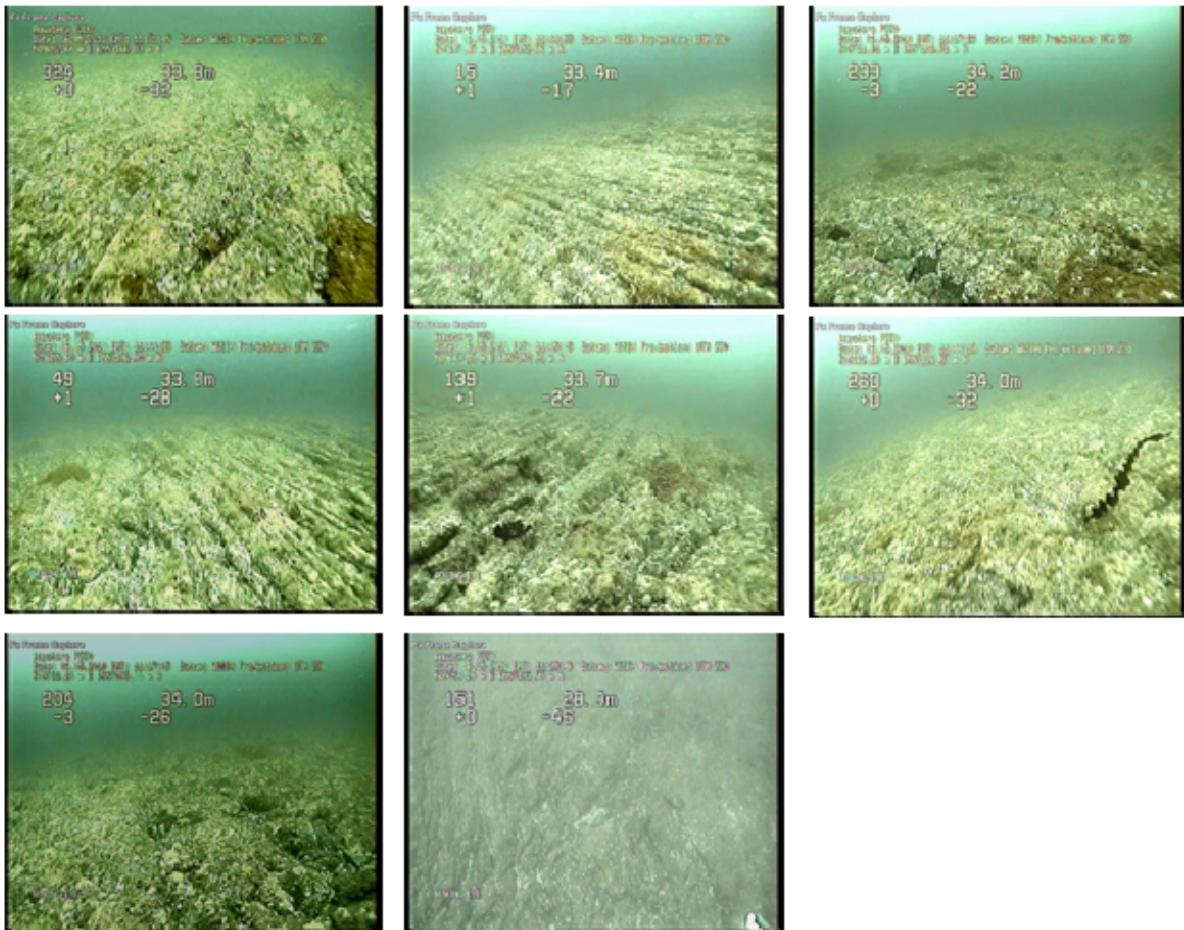
**Figure 2.3** Location of ROV transects



### 3 Survey footage analysis and discussion

The results of the seabed survey indicated that the seabed at the proposed site was predominately composed of heavily scoured bedrock slabs with areas of boulders. No distinct patches of sand, gravel or fine sediment were observed (Figure 3.1). This type of high-energy environment severely restricts the development of benthic communities and only occasional small kelp plants, encrusting algae and barnacles were clearly observed on the bedrock surfaces exposed to the tidal current. There was, however evidence of cryptic communities existing in crevices, under overhangs, and around areas of boulders. A number of urchins, whelks and other molluscs, and small sponges appeared to be present; however, a detailed assessment of the species present in these areas was not possible from the ROV footage. This area differs from the shallower areas nearby where dense patches of kelp plants with an understory of seaweeds and animals were found (Aquaterra, unpublished studies).

**Figure 3.1 Examples of the seabed conditions present in the area (6 May 2010, ROV survey)**





## 4 Equipment Details

### 4.1 Survey vessel – *MV Guide*

The MV Guide is a Class VI passenger vessel, and has a category 4 Work Boat Certificate, which gives her a wide range of uses from passenger transfer to coastal survey purposes.



## 4.2 ROV specifications

### STANDARD FALCON FEATURES INCLUDE:

- 300 m (1,000 ft) depth rating, 8.5 kg (19 lbs) payload
- Max 450 m umbilical length upgradeable to 1100 m length with F2 Fibre Optic Pack upgrade
- Magnetically coupled brushless DC thrusters with velocity feedback - 4 vectored and 1 vertical
- 50 kgf (110 lbs) of thrust with 1:1 power to weight ratio, without additional payload
- Distributed intelligence control system
- High resolution colour camera on 180° tilt platform
- Variable intensity 150 Watts of lighting
- Auto heading and depth
- Single phase 100-270 VAC universal auto sensing power input at 2.8 kW.



| SPECIFICATIONS            | FALCON                               |
|---------------------------|--------------------------------------|
| System power requirements | Single phase<br>100-270 VAC at 2.8kW |
| Maximum umbilical length  | 450 m                                |
| Depth rating              | 300 msw                              |
| Length                    | 1000 mm                              |
| Height                    | 500 mm                               |
| Width                     | 600 mm                               |
| Launch weight             | 55 kg                                |
| Forward speed             | > 3 knots                            |
| Thrust forward            | 50 kgf                               |
| Thrust lateral            | 28 kgf                               |
| Thrust vertical           | 13 kgf                               |
| Payload                   | 8.5 kg                               |

### 4.3 USBL Information

Triscom Marine mobilised alongside the Falcon ROV aboard the Guide on the 5nd May 2010.

| <i>item</i>                      | <i>purpose</i>                              | <i>specification</i>                             |
|----------------------------------|---|--|
| Triscom "PHReD"                  | surface positioning of vessel               | <5m accuracy<br>(within spec IHO4/98 Order 2)    |
|                                  | vessel true heading reference               | <0.08° 95%                                       |
| Triscom "ONDAU"                  | acquisition, display & logging              | IBM compatible marinised PC                      |
| Applied Acoustics ET-USBL        | subsea positioning of ROV                   | <5% slant range<br>(within spec IHO4/98 Order 2) |
| UPS                              | power backup                                | 20 mins at 500VA                                 |
| Applied Acoustics MST tranponder | ROV-mounted omnidirectional acoustic beacon | 30kHz band<br>12 hour rechargable battery        |
| software                         | graphical display & expedition              | EIVA NaviPac                                     |
|                                  | collecting survey data                      | EIVA NaviPac                                     |

The D-GPS (Hemisphere Vector) was mounted on top of the deckhouse, aft & amidships to give the best possible sky view. Online survey equipment was mobilised inside the deckhouse main cabin with a remote display into the wheelhouse to enable the helmsman and ROV pilot to navigate precisely.

The USBL was mounted overside on a purpose-made pole on the port bow of the vessel.

### Vessel Offsets

A Central Reference Point (CRP) was decided upon - in this case the aftermost midships point of the stern counter and relevant offsets were measured:

| <i>item</i>                | <i>X (mm) +stbd</i> | <i>Y (mm) +fwd</i> | <i>Z(mm) +up</i> | <i>desc</i>              |
|----------------------------|---------------------|--------------------|------------------|--------------------------|
| CRP                        | 0                   | 0                  | 0                | stern centreline         |
| D-GPS antenna phase center | 0                   | 3900               | 4031             | amidships deckhouse roof |
| USBL transducer            | -2250               | 14290              | -2300            | pole, stbd coaming       |

### Geodetic parameters

No preferred geodesy was specified by the client. For convenience, UTM Zone 30 projection was used with no datum shift from WGS84. Where appropriate in the report, coordinates are given in WGS-84 geographicals in degrees and minutes, for maximum compatibility with workboat GPS systems.

| <i>DATUM PARAMETERS WGS84</i> |              |
|-------------------------------|--------------|
| Spheroid                      | WGS84        |
| semi-major axis               | 6378137.000m |
| semi-minor axis               | 6356752.314m |
| inverse flattening (1/f)      | 1/298.257    |
|                               | 0.0033528    |

| <i>Projection parameters - UTM Zone 30</i> |                               |
|--|-------------------------------|
| Projection                                 | Universal Transverse Mercator |
| UTM ZONE                                   | 30                            |
| Central Meridian                           | 3° West (-003°)               |
| False Easting                              | 500,000m                      |
| False Northing                             | 0m                            |
| Scale Factor at Central Meridian           | 0.999600                      |

## 5 Survey Log

**Client** : AQUATERA  
**Vessel** : GUIDE  
**Location** : HOUTON/KIRKWALL  
**Project** : P330

**Date** : 5 MAY 2010  
**Job No** : TT1003  
**Sheet No** : 1

| Time | Activity   |
|------|--|
| 1000 | Commence mobilisation of survey equipment onto Guide together with ROV |
| 1300 | Depart Houton for Kirkwall   |
| 1700 | Arrive Kirkwall  |

**Client** : AQUATERA  
**Vessel** : GUIDE  
**Location** : KIRKWALL  
**Project** : P330

**Date** : 6 MAY 2010  
**Job No** : TT1003  
**Sheet No** : 1

| Time GMT | Activity   |
|----------|--|
| 0720     | depart Kirkwall for Falls of Warness                               |
| 0910     | At location, test dive of ROV & survey equipment                   |
| 0920     | Check navigation systems by locating EMEC Nr 2 cable               |
| 1110     | ROV in water - dive 1  |
| 1116     | Commence transect SE to NW through worksite, downtide              |
| 1125     | End transect, recover ROV to deck                                  |
| 1130     | ROV in water - dive 2  |
| 1130     | Commence wingline transect SE to NW to the NORTH of site center    |
| 1135     | End transect, recover ROV to deck                                  |
| 1140     | ROV in water - dive 3  |
| 1142     | Commence wingline transect SE to NW to the SOUTH of site center    |
| 1146     | End transect, recover ROV to deck                                  |
| 1155     | Weather deteriorating & causing wave height to affect safe working |
| 1200     | depart Falls of Warness for Kirkwall Harbour                       |
| 1400     | Arrive Kirkwall Harbour & demobilise                               |