

National Tidal and Sea Level Facility

2012 Annual Report for the
UK National Tide Gauge Network
and Related Sea Level Science

Edited by Paul McGarrigle

National Tidal and Sea Level Facility: Annual Report for 2012 for the UK National Tide Gauge Network and Related Sea Level Science

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Thanks also to all those involved in maintenance of the network, data retrieval, processing, quality control and delivery.

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Foreword

The National Tidal and Sea Level Facility (NTSLF) is the UK centre of excellence for sea level monitoring, coastal flood forecasting and the analysis of sea level extremes. Based at the National Oceanography Centre in Liverpool, with research partners in UK universities and the Met Office, it was established in 2002 to reflect the importance of national sea level monitoring to government, the academic community and the public.

NTSLF provides technical expertise to a wide community and supplies quality-controlled data with a range of practical and scientific applications including:

- Tidal prediction and sea level monitoring for the UK National Tide Gauge Network and at key sites in the South Atlantic Ocean and British Overseas Territories.
- Storm surge forecasting.
- Determination of extreme sea levels for coastal engineering design
- Studies into climate change, including contributions to the Intergovernmental Panel on Climate Change (IPCC).

The British Oceanographic Data Centre (BODC) carries out the processing, quality control and dissemination of NTSFL data. Quality-controlled data from the UK National Tide Gauge Network are accessible free of charge via BODC's website.

2012 saw the upgrade of the remaining 20 tide gauge sites to the new Swantel telemetry system. The Port Ellen tide gauge remains decommissioned - reinstallation is planned for 2013.

We would like to thank Environment Agency, who own and fund the UK National Tide Gauge network, as well as all those who contribute towards, and make use of, the NTSFL.

Dr Angela Hibbert
Tidal and Sea Level Scientist
NTSLF

Tide Gauge Instruments

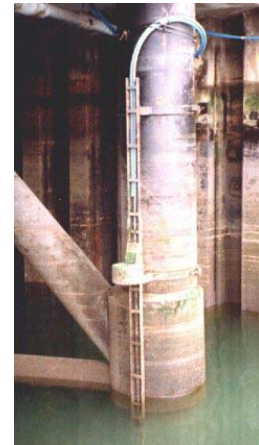
Full-tide Bubbler

The full tide bubbler system normally consists of two independent measuring systems. The pressure points are mounted approx 1m below Admiralty Chart Datum (ACD) so that negative surges can be recorded. The pressure points visible underwater in the photograph resemble an inverted bucket with a copper nozzle mounted on the side. This nozzle is the actual measuring point. A low flow of dry air (normally 7ml/min) is fed down an air tube to the top of the pressure point. When the air pressure in the tube equals the pressure exerted by the column of water above it, then the excess air is released as bubbles through the nozzle. This means the pressure in the air line is proportional to the weight of the water column.



Mid-tide Bubbler

The operation of the mid tide bubbler is similar to that of the full-tide system, except that the measuring point is mounted at the mid tide height. This means that the pressure point is only immersed for half of the tidal cycle. This is so that when the measuring point is exposed as in the photograph it can be levelled accurately into the geodetic network. Once this is accomplished the full tide pressure points can be fitted to match the tidal curve produced by the mid tide pressure point, thereby connecting them to the geodetic network.



Pressure Transducer

These are differential transducers contained in a watertight housing. The reference port is vented to atmosphere via the power supply and signal cable tube, while the measuring port of the transducer is connected to a copper outlet nozzle on the top of the transducer housing. The nozzle, transducer measuring port and connecting tube are filled with oil. The pressure is transmitted to the crystal element via the oil, keeping the transducer components free from the effects of the saltwater.

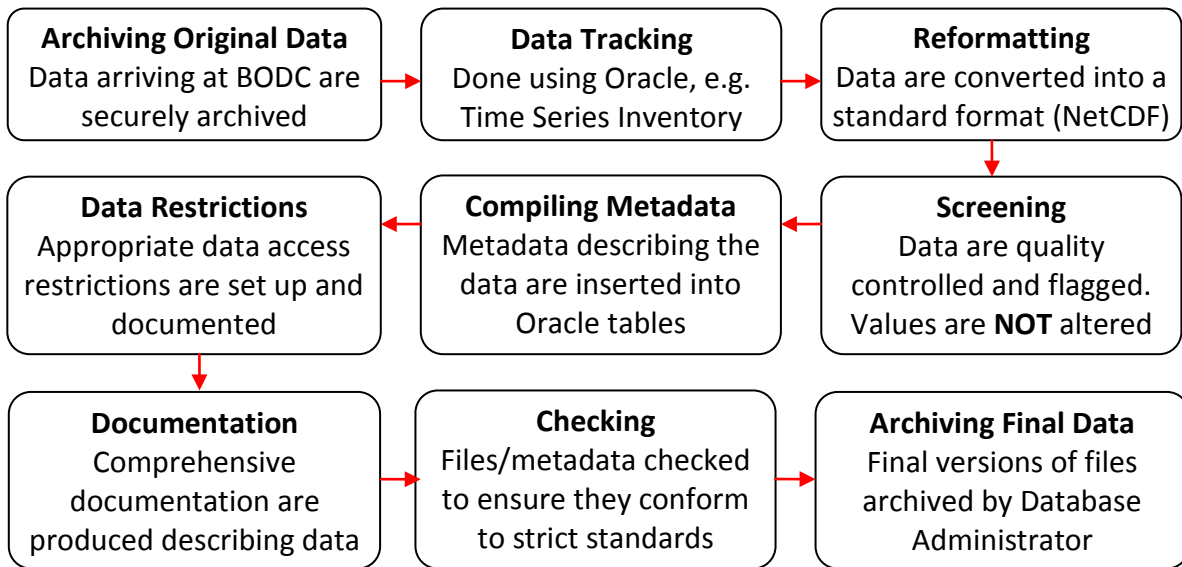


Munro Float Gauge

The Munro gauge measures sea level using a float in a stilling well. The float is about 45cm in diameter - the large diameter reduces inevitable errors in buoyancy due to friction of the gearing and small changes in the length of float wire. This wire is coiled round a drum on the end of the gauge. Another drum contains a counterbalance wire. The drum is geared to a slotted tape attached to a pen carriage, which traces the tide curve on the chart. A precision potentiometer is attached to the gauge to provide an input to the data logger.



Data Processing



Flowchart summarising BODC data processing steps

Data arrive at BODC every week, where they are screened. The data are reviewed and then uploaded to the BODC website each month. They are reviewed annually before being banked (archived) in BODC's National Oceanographic Database. This process is described in more detail below.

Quality Control

All data arriving at BODC are converted to a common standard format. This makes storage and distribution much easier and ensures that parameter codes, flags, units, absent data values, etc, are consistent between different sources. We use a platform-independent binary format called QXF, a sub-set of NetCDF.

Data are quality-controlled weekly, monthly and annually using in-house software. This involves inspecting both recorded values and non-tidal residuals. Examining residuals is especially useful for detecting instrument faults (timing errors, datum shifts, spikes). Harmonic constants may be severely corrupted if the site has highly nonlinear tides, or is influenced by rivers/estuaries or particularly complex basin configuration. To produce more accurate predicted tides, we compute 'fresh' tidal constants from recent data, using Doodson harmonic analysis, rather than just relying upon historical values.

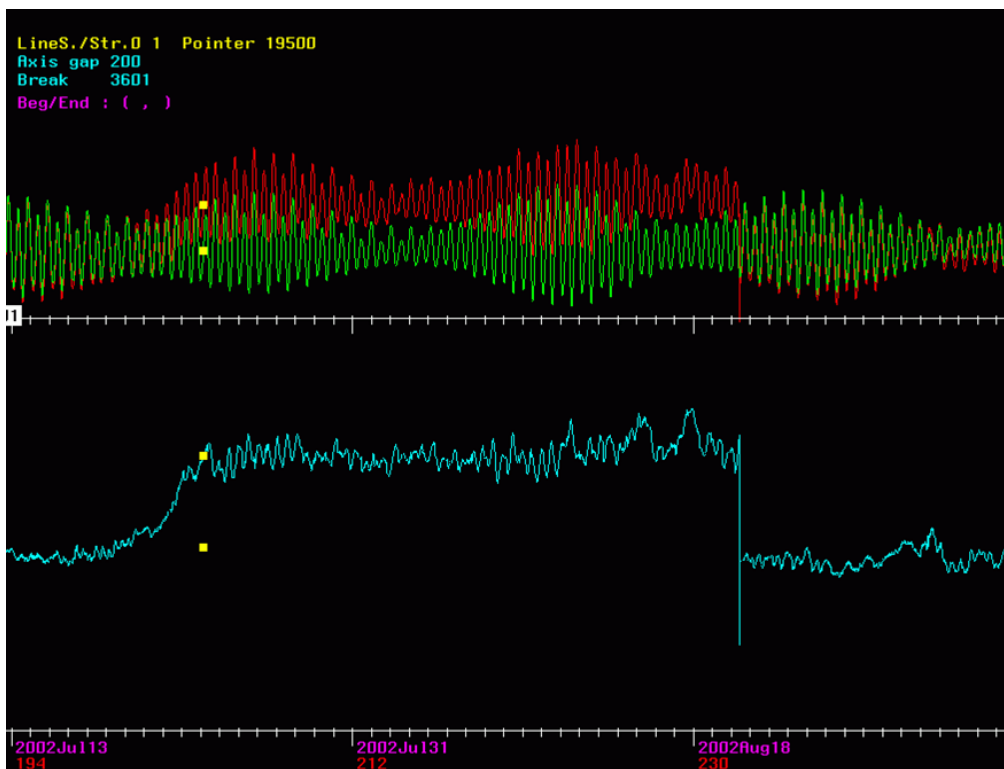
The standard procedure at BODC for the weekly quality control of sea level data includes, where possible:

- Screening the series, looking for spikes, gaps, timing errors and datum shifts
- Screening the series with previous series from the same site
- Screening the series with neighbouring stations covering the same period
- Displaying other parameters, such as sea temperature and atmospheric pressure, to aid quality control

Monthly processing includes checking the statistics produced, e.g., mean sea level, with those produced in previous years.

The annual quality-control process involves producing a tidal analysis and comparing M2, S2, N2, K1, O1, and Z0 constituents with previous data series, adjacent sites and the Admiralty Tide Tables for the closest site.

Data values are considered suspicious if the measured value differs by more than approximately 20mm (for a site of average tidal range) from either the mid-tide channel (if one exists at the site) or the predicted value. The person screening the data will often have to use their own judgement. Suspicious data points are flagged 'M' and any timing errors or datum shifts are noted. An 'N' flag is assigned to those values that are null. No data values are changed. The data quality is noted in accompanying documentation.



Screenshot of BODC visualisation software showing data, analysis and residual
(Legend: Tidal observations (m), Tidal predictions (m) and Residual (m))

Metadata and Documentation

Additional information (metadata) is needed not only for quality control and archiving, but also for exchanging data or integrating them into a regional or global data set. Basic metadata quality control includes checking that, for example, latitude and longitude or start/end dates of records are reasonable.

Sufficient documentation should accompany each data series to ensure that the data can be used with confidence by a secondary user. This documentation should be stored alongside the data, and where applicable, should cover:

Site information

- Brief description of location of tide gauge peculiar characteristics of the tide gauge site (for example, complex local geography, seiching, silting of the harbour, river mouths) (including maps, photos)
- Description of tide gauge benchmarks, their history and method of determination (including maps, photos)
- Datum relationships - Measurements must be relative to a fixed and permanent local tide gauge bench mark (TGBM). This should be connected to auxiliary marks to guard against its movement or destruction. Connections between the TGBM and the gauge zero should be made to an accuracy of a few millimetres regularly (e.g. annually)

Data sampling and processing details

- Sampling scheme e.g. continuous recording, instantaneous, averaged
- Interval between samples and duration of individual samples (raw data)
- Nominal interval of processed data
- Gaps in the data record
- Timing and/or datum corrections applied
- De-spiking/smoothing/interpolating methods and editing procedures

Instrument information

- Instrument description, manufacturer, model, principle of measurement, method of recording - refer to publication or briefly describe
- Instrument modifications and their effect on the data
- Method and times of calibration, calibration factors
- Frequency of cleaning, control of biological fouling
- Operational history
- Pertinent instrument characteristics; for example, for a conventional stilling well, information should include well diameter, orifice depth below mean water level and orifice height above sea bed; for a bubbler gauge - tube length, tube diameter, orifice diameter, density value used to convert to elevation, acceleration due to gravity and the formula used to compensate for tube length.

Auditing and Banking

The metadata and documentation are checked before banking. A Matlab script cross-references the data header files against the metadata to ensure no data-entry errors have been made. Another script checks the data files to make sure timing errors, out-of-range values and nulls have been dealt with.

Datasets that have been completely processed are audited. A second data scientist completes a series of final checks. Any differences of opinion are highlighted and re-examined. Files are then archived and marked as 'banked'. Finally, monthly files are concatenated into yearly files and the yearly file metadata are banked in a database.

Calculating Statistics

Edserplo calculates four types of summary information

- a history of when the tide gauge has been in operation (“history”)
- monthly extremes (“extremes”)
- monthly extreme surges (“surges”)
- monthly and daily mean sea level (“MSL”)

Gaps greater than 4.1 hours in the primary channel are registered as gaps in the history.

Extremes are the maximum and minimum calculated over all sampled data during the month. This excludes any interpolated data but may include rapidly sampled data. Extreme surges (residuals) are calculated in the same way from tidal residuals. Tidal residuals are defined to be the measured water level minus the predicted tide. The predictions derive from the database of tidal constants maintained by NOC’s Applications Group (as defined at the time of the calculation) for the ports of the UK and elsewhere.

Mean Sea Level is calculated from a filter working on quarter-hourly values derived from one or more cubic splines applied to the raw data. The filter is a convolution of Vassie’s O3B filter which converts 15-minute data to hourly values and Doodson’s X0 filter. Splines are not applied across gaps as defined above. Short gaps can therefore lead to the loss of a day of output data (the half length of the filter is 91 and a day is 96 samples). Provided there are some daily (@12:00Z) values these are then averaged to provide the monthly value.

The Permanent Service for Mean Sea Level (PSMSL) recommend refraining from computing a mean sea level value there isn't sufficient data available. Consequently, the monthly statistics given in this report do not feature a mean sea level value for any month where more than 15 days of data are missing (the values given for extremes and surges for these months should be treated with caution). Similarly, there is no yearly mean sea level figure given if more than two monthly mean values are missing. If there are 11 monthly means available, the annual mean is calculated from a weighted average of these (the weight for each month being the number of days for which readings exist).

Issues with Migration

The migration of the remaining sites to the EA's Swantel system and the installation of the S500 datalogger affected the data quality and completeness figures for the year.

As occurred last year, some data was lost at the time of migration when essential tests were carried out to ensure the logger was functioning correctly.

UK Tide Gauge Network Map

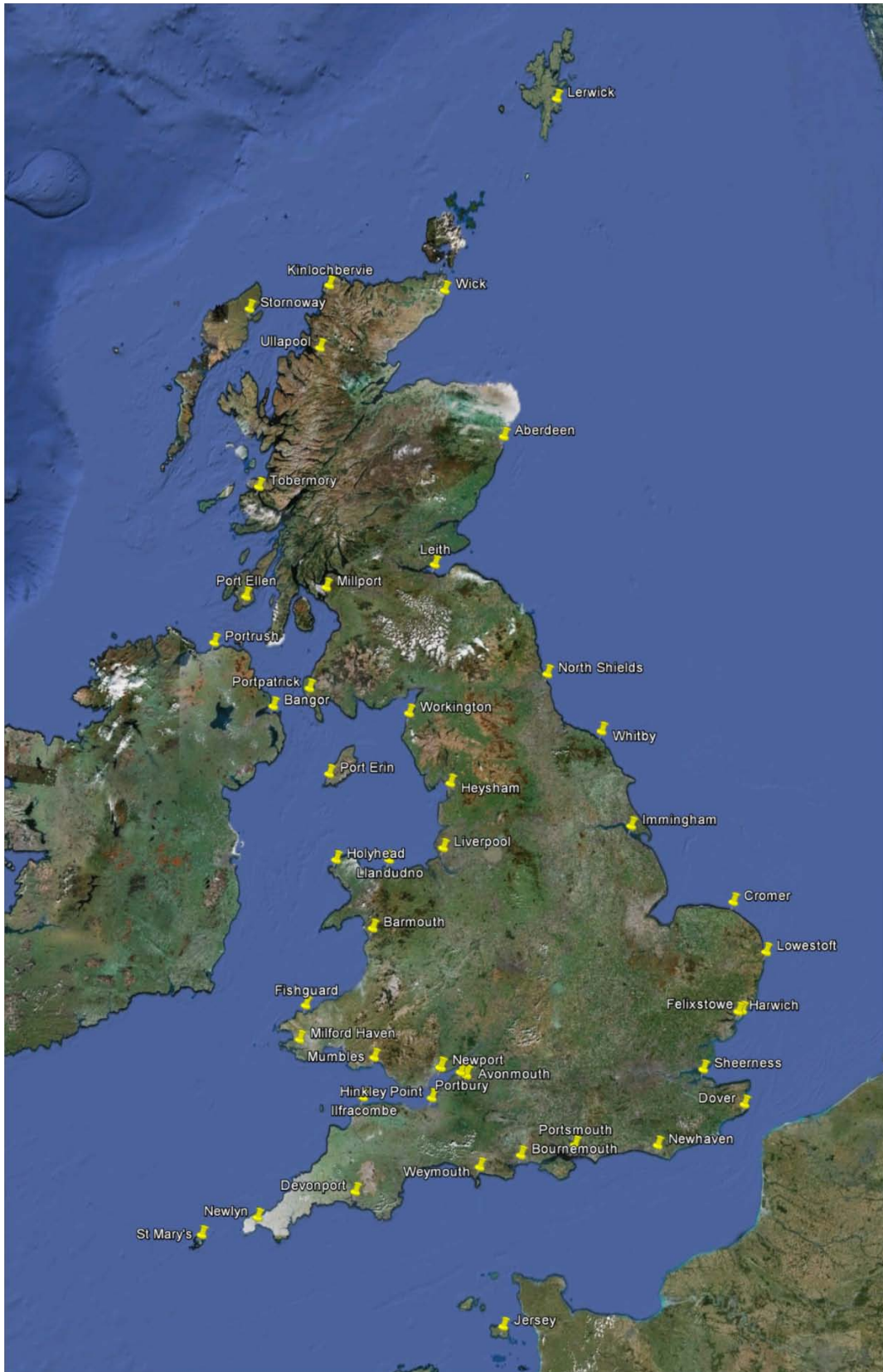
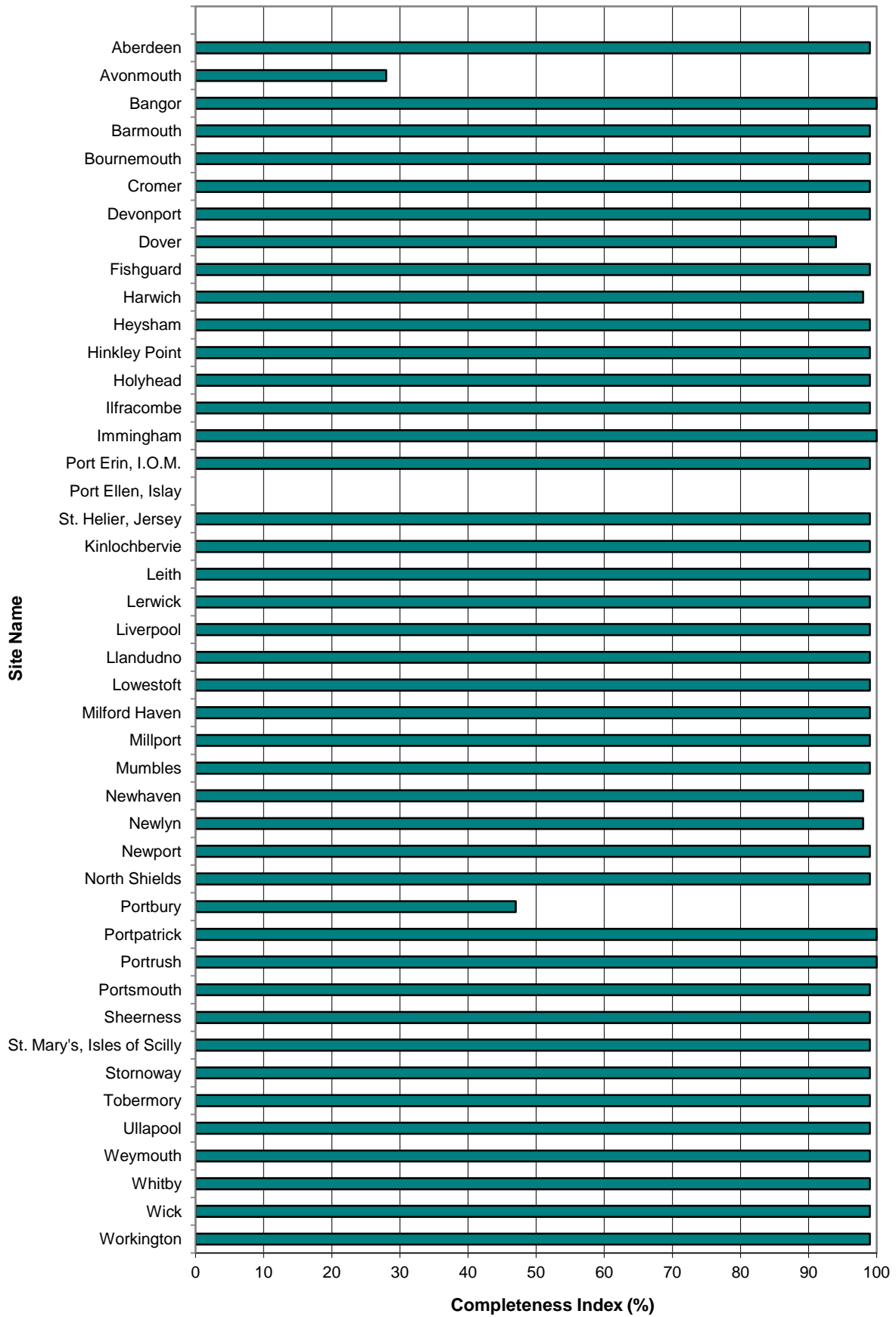


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Completeness Index (CI%) for UK Tide Gauge sites



Aberdeen – Tide Gauge Information

Latitude 57° 08' 38.5" N **Longitude** 02° 04' 38.5" W **Grid Ref** NJ 9525 0591

Instrument Data acquisition system with two full tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** Waterloo Quay

Measuring Points The South West corner of Telford Dock

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NJ 9525 0590	New bolt N side jetty Waterloo Quay
Aux1	NJ 9572 0593	Building NW side York Place SE face E angle
Aux2	NJ 9586 0571	Observatory Pocra Quay N face NW angle
Aux3	NJ 9524 0600	Building NE side Waterloo Quay SW face S angle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.25m below Ordnance Datum Newlyn (ODN)

TGZ = 6.318m below TGBM

Levelling No levelling was carried out in 2012

Site visits

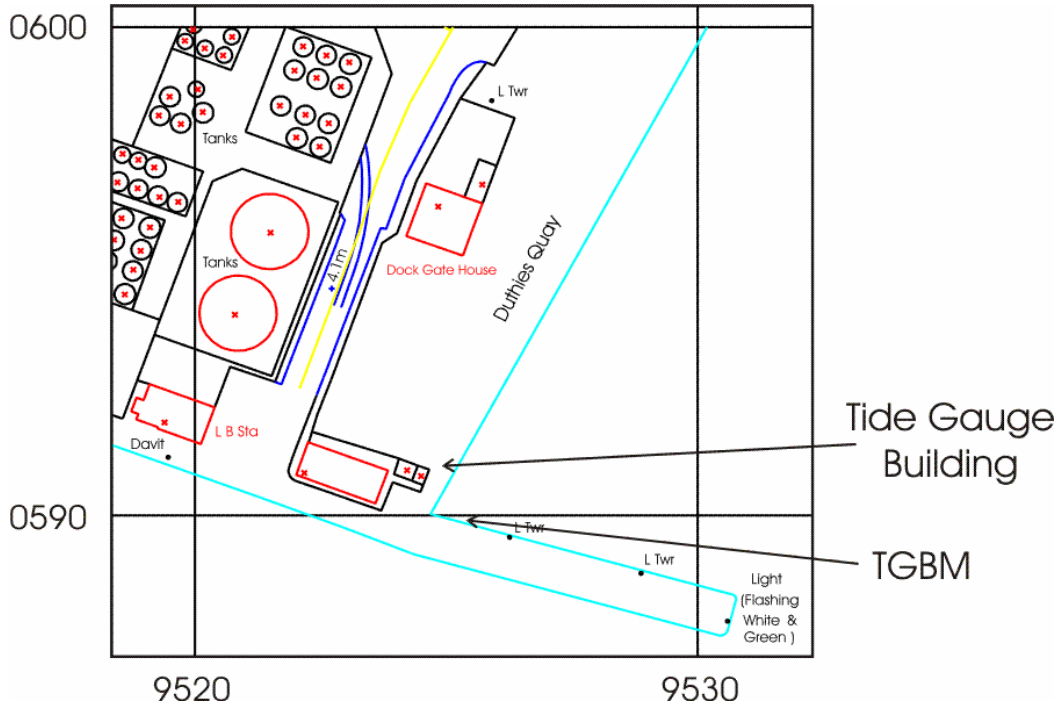
Day 119 Visit to investigate data recording errors

Day 279 Divers cleaned and cleared blocking nozzle and fittings

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	004,115-119,312-318,333-353

Aberdeen – Map & Images of Site



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Tide gauge location



Aerial view of site

Aberdeen – Statistics

Surge maxima	Value	Day	Time
January	0.604	3	22:45:00
February	0.336	24	02:15:00
March	0.405	7	09:30:00
April	0.365	10	05:15:00
May	0.51	14	04:30:00
June	0.261	29	16:30:00
July	0.249	23	00:30:00
August	0.377	28	06:15:00
September	0.593	14	08:30:00
October	0.385	31	22:15:00
November	0.414	20	09:30:00
December	0.739	29	17:30:00

Surge minima	Value	Day	Time
January	-0.39	6	08:00:00
February	-0.496	10	11:00:00
March	-0.289	13	00:00:00
April	-0.34	30	16:45:00
May	-0.345	1	03:30:00
June	-0.145	14	19:15:00
July	-0.155	8	15:15:00
August	-0.256	31	09:30:00
September	-0.285	26	06:45:00
October	-0.253	26	02:15:00
November	-0.33	27	09:45:00
December	-0.339	28	14:30:00

Extreme maxima	Value	Day	Time
January	4.561	12	15:15:00
February	4.619	24	14:45:00
March	4.723	9	14:00:00
April	4.826	9	15:00:00
May	4.498	7	13:45:00
June	4.506	6	14:30:00
July	4.421	5	01:45:00
August	4.561	4	02:15:00
September	4.72	17	01:30:00
October	4.815	17	01:45:00
November	4.703	16	02:30:00
December	4.856	29	13:45:00

Extreme minima	Value	Day	Time
January	0.331	24	20:15:00
February	0.026	10	21:00:00
March	0.056	10	20:45:00
April	0.164	7	19:45:00
May	0.335	6	19:30:00
June	0.406	5	07:30:00
July	0.271	6	09:00:00
August	0.384	31	06:45:00
September	0.45	19	09:00:00
October	0.464	15	06:45:00
November	0.568	15	20:00:00
December	0.843	19	00:00:00

Mean sea level	Days	MSL
January	31	2.602
February	29	2.447
March	31	2.462
April	25	2.516
May	31	2.456
June	30	2.520
July	31	2.528
August	31	2.573
September	30	2.646
October	31	2.639
November	17	2.767
December	12	*
	Sum	Avg
	329	2.573

* No mean sea level value as more than 15 days of data missing

Avonmouth – Tide Gauge Information

Latitude 51° 30' 27.6" N **Longitude** 02° 42' 45.9" W **Grid Ref** ST 5063 7899

Instrument Data acquisition system with dual underwater pressure transducers
Location **Tide Gauge Building** Between disused oil jetty and fuel storage depot
Measuring Points The seaward end of the oil jetty

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	ST 5057 7881	OSBM bolt at base of bollard
Aux1	ST 5072 7859	Rivet adjacent to transit shed NW face W angle
Aux2	ST 5063 7898	Rivet base building NW side S angle
Ref M	ST 5047 7934	Ref mark on seaward end of jetty

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 6.50 m below Ordnance Datum Newlyn (ODN)
 TGZ = 15.711 m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 092 Visit to undertake decommissioning work

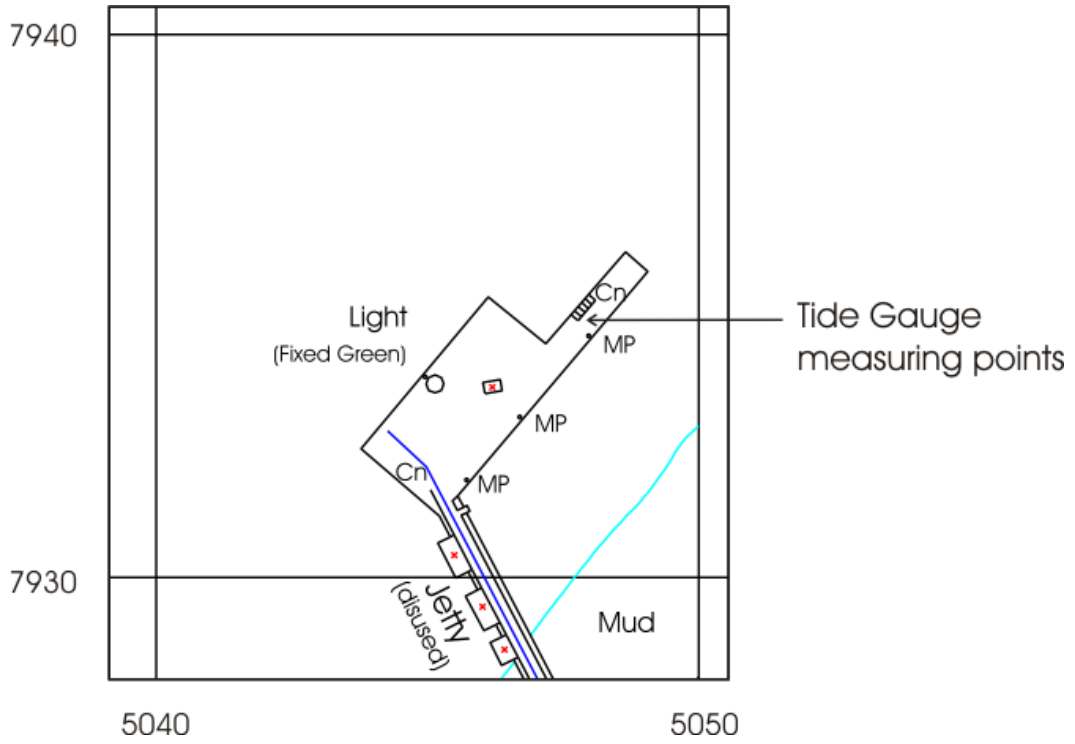
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
28%	15 minutes	102-366	067-079,081-086,088-092,094-102

Notes on Completeness/Quality

Gauge was switched off in April. No data missing before this point.

Avonmouth – Map & Images of Site



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Avonmouth – Statistics

Surge maxima	Value	Day	Time
January	1.396	3	05:45:00
February	0.585	22	14:00:00
March	0.71	31	06:45:00
April	0.607	1	08:00:00
May			
June			
July			
August			
September			
October			
November			
December			

Surge minima	Value	Day	Time
January	-0.633	4	04:15:00
February	-0.77	2	04:30:00
March	-0.778	12	05:00:00
April	-0.285	1	13:45:00
May			
June			
July			
August			
September			
October			
November			
December			

Extreme maxima	Value	Day	Time
January	13.662	24	08:00:00
February	13.606	10	08:45:00
March	14.128	10	08:30:00
April	14.405	9	08:45:00
May			
June			
July			
August			
September			
October			
November			
December			

Extreme minima	Value	Day	Time
January	0.985	24	02:30:00
February	0.406	10	16:00:00
March	0.379	12	04:45:00
April	0.477	8	03:00:00
May			
June			
July			
August			
September			
October			
November			
December			

Mean sea level	Days	MSL
January	31	6.986
February	29	6.788
March	7	*
April	1	*
May	0	*
June	0	*
July	0	*
August	0	*
September	0	*
October	0	*
November	0	*
December	0	*
	Sum	Avg
	68	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Bangor – Tide Gauge Information

Latitude 54° 39' 53.1" N **Longitude** 05° 40' 10.1" W **Grid Ref** NW 6340 3620

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** Central Pier at Bangor Marina
Measuring Points The seaward side of the open pier, directly beneath the tide gauge building

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	5043 8212 (Sheet 115)	S S Pin Tide gauge building Central Pier
Aux1	5038 8200 (Sheet 115)	Cut mark Clock tower

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 2.01m below Ordnance Datum Belfast (ODB)
 TGZ = 5.592m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 145 Upgraded telemetry outstation hardware and replaced compressor
 Day 262 Divers cleaned and serviced all three channels

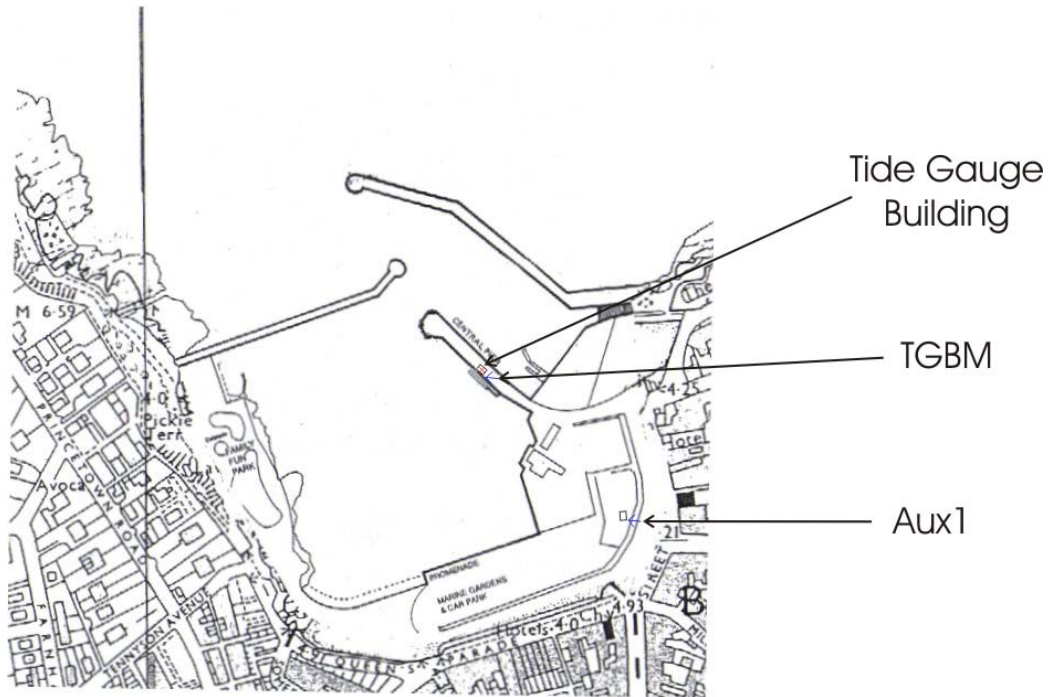
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
100%	15 minutes	None	001-002,004-012,015-019,021-032,034-035,045,049,056,096-114,117-130,132-145,213-214,218-219,228-234,237-238,240,243,262,349-355

Notes on Completeness/Quality

Both channels were noisy during January and although the issue appeared resolved during February, a maintenance visit during May revealed that the pressure points were occasionally blocking. The pneumatic lines were purged to rectify this.

Bangor – Map & Images of Site



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Bangor – Statistics

Surge maxima	Value	Day	Time
January	1.179	3	09:00:00
February	0.284	22	16:30:00
March	0.37	3	16:00:00
April	0.319	9	18:15:00
May	0.218	8	05:45:00
June	0.324	15	18:30:00
July	0.184	4	04:45:00
August	0.499	27	18:00:00
September	0.353	14	04:45:00
October	0.51	17	17:15:00
November	0.649	19	10:45:00
December	0.71	29	04:00:00

Surge minima	Value	Day	Time
January	-0.473	5	19:45:00
February	-0.53	14	03:00:00
March	-0.369	5	13:15:00
April	-0.538	4	21:00:00
May	-0.264	12	01:30:00
June	-0.167	3	21:30:00
July	-0.2	25	15:15:00
August	-0.264	30	13:30:00
September	-0.237	26	20:45:00
October	-0.279	27	01:15:00
November	-0.474	27	10:00:00
December	-0.479	5	09:45:00

Extreme maxima	Value	Day	Time
January	3.882	25	12:45:00
February	3.788	22	11:15:00
March	3.616	7	10:00:00
April	3.878	9	12:45:00
May	3.686	10	01:30:00
June	3.791	8	01:30:00
July	3.689	4	23:45:00
August	3.78	2	23:30:00
September	3.84	18	00:00:00
October	4.114	18	00:00:00
November	4.116	19	14:45:00
December	4.023	31	12:30:00

Extreme minima	Value	Day	Time
January	0.14	12	19:00:00
February	0.099	10	18:45:00
March	0.028	10	18:15:00
April	0.137	4	15:00:00
May	0.296	5	16:00:00
June	0.338	4	04:15:00
July	0.306	6	06:30:00
August	0.284	31	04:30:00
September	0.352	19	06:30:00
October	0.446	27	03:00:00
November	0.426	15	17:45:00
December	0.443	11	02:15:00

Mean sea level	Days	MSL
January	5	*
February	24	1.850
March	31	1.871
April	5	*
May	6	*
June	30	2.052
July	30	2.024
August	15	*
September	30	2.087
October	31	2.154
November	30	2.182
December	23	2.152
	Sum	Avg
	260	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Barmouth – Tide Gauge Information

Latitude 52° 43' 09.6" N **Longitude** 04° 02' 42.1" W **Grid Ref** SH 6197 1548

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** Toll booth on the north end of Barmouth railway bridge
Measuring Points Attached to the first leg of the railway bridge in the deep channel

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SH 6197 1548	NBM rivet concrete 2.9M NE wall junction
Aux 1	SH 6173 1558	Rivet step NE side of road NW entrance path
Aux 2	SH 6186 1556	Rivet wall SE side road 17.6M E steps
Aux 3	SH 6196 1550	Rivet step E side lifeboat station

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.44m below ODN

TGZ = 10.363m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 161 Investigated power outage

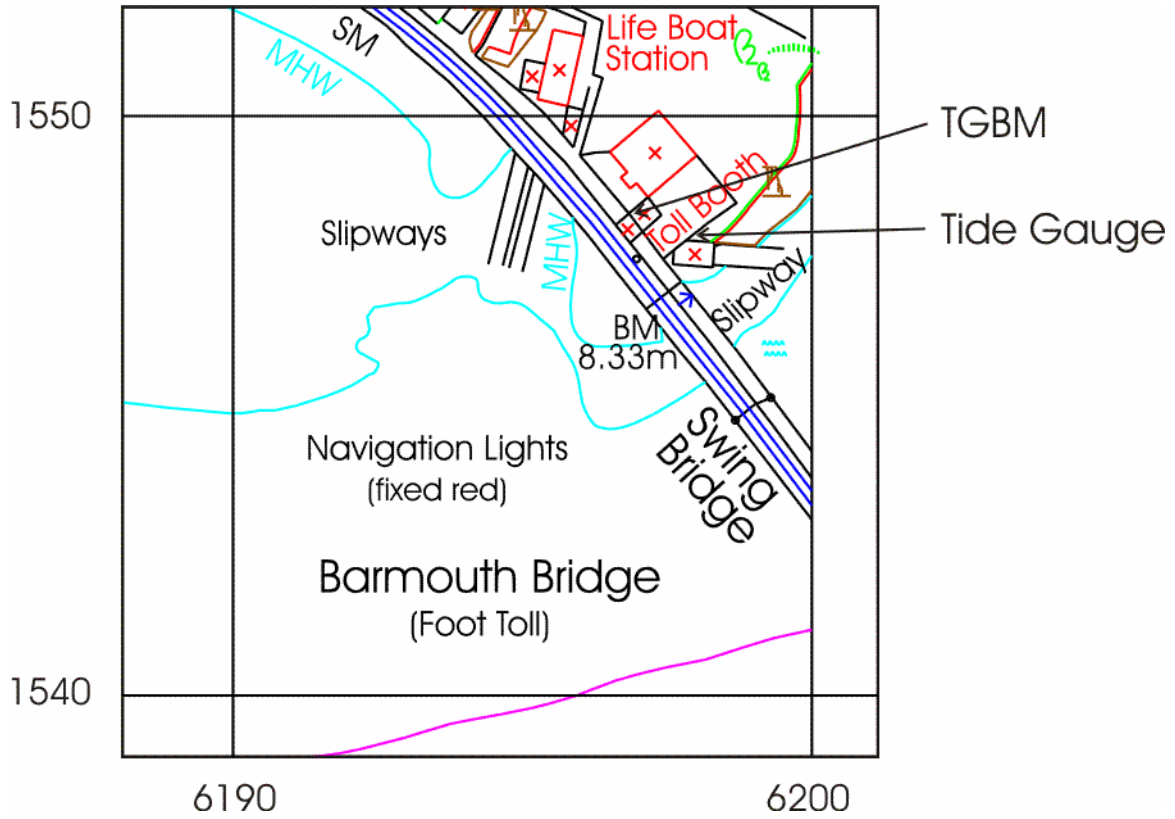
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	001-175,187-189,191,216-220,275-336

Notes on Completeness/Quality

The primary channel was reading ~40-50mm high. An adjustment was made during February but the problem recurred.

Barmouth – Map & Images of Site



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Barmouth – Statistics

Surge maxima	Value	Day	Time
January			
February			
March	0.32	7	09:15:00
April			
May			
June	0.374	22	17:45:00
July	0.492	16	12:15:00
August	0.701	15	13:30:00
September	0.408	25	18:15:00
October	0.396	2	23:30:00
November	0.563	22	23:00:00
December	0.768	6	19:30:00

Surge minima	Value	Day	Time
January			
February			
March	-0.332	11	13:30:00
April			
May			
June	-0.131	27	21:00:00
July	-0.206	21	05:00:00
August	-0.342	30	16:45:00
September	-0.307	13	02:45:00
October	0.036	1	01:15:00
November	-0.483	27	16:45:00
December	-0.505	8	00:00:00

Extreme maxima	Value	Day	Time
January			
February			
March	5.192	11	10:30:00
April			
May			
June	4.897	23	22:45:00
July	5.356	4	20:45:00
August	5.458	2	20:30:00
September	5.716	17	21:00:00
October	4.461	2	23:00:00
November	3.516	22	18:00:00
December	5.81	14	20:45:00

Extreme minima	Value	Day	Time
January			
February			
March	0.794	12	04:45:00
April			
May			
June	1.072	25	06:30:00
July	0.727	6	05:15:00
August	0.734	31	03:30:00
September	0.772	19	05:45:00
October	1.1	1	03:15:00
November	0.916	27	14:45:00
December	0.842	12	02:00:00

Mean sea level	Days	MSL
January	0	*
February	0	*
March	0	*
April	0	*
May	0	*
June	7	2.739
July	28	2.714
August	26	2.809
September	29	2.764
October	0	*
November	0	*
December	30	2.886
	Sum	Avg
	120	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Bournemouth – Tide Gauge Information

Latitude 50° 42' 51.6" N **Longitude** 01° 52' 29.5" W **Grid Ref** SZ 0893 9053

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge
Location **Tide Gauge Building** Electrical room at the west side of the South Pier
Measuring Points Directly below the electrical room, on a pier leg

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
Aux1	SZ 0869 9066	Cut mark Wall
Aux2	SZ 0893 9083	Cut mark Pillar
REF A	SZ 0893 9052	Steelwork clamp
REF B	SZ 0893 9052	Mid-tide pressure point nozzle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 1.40m below ODN

TGZ = 5.96m below Aux1

Levelling No levelling was carried out in 2012

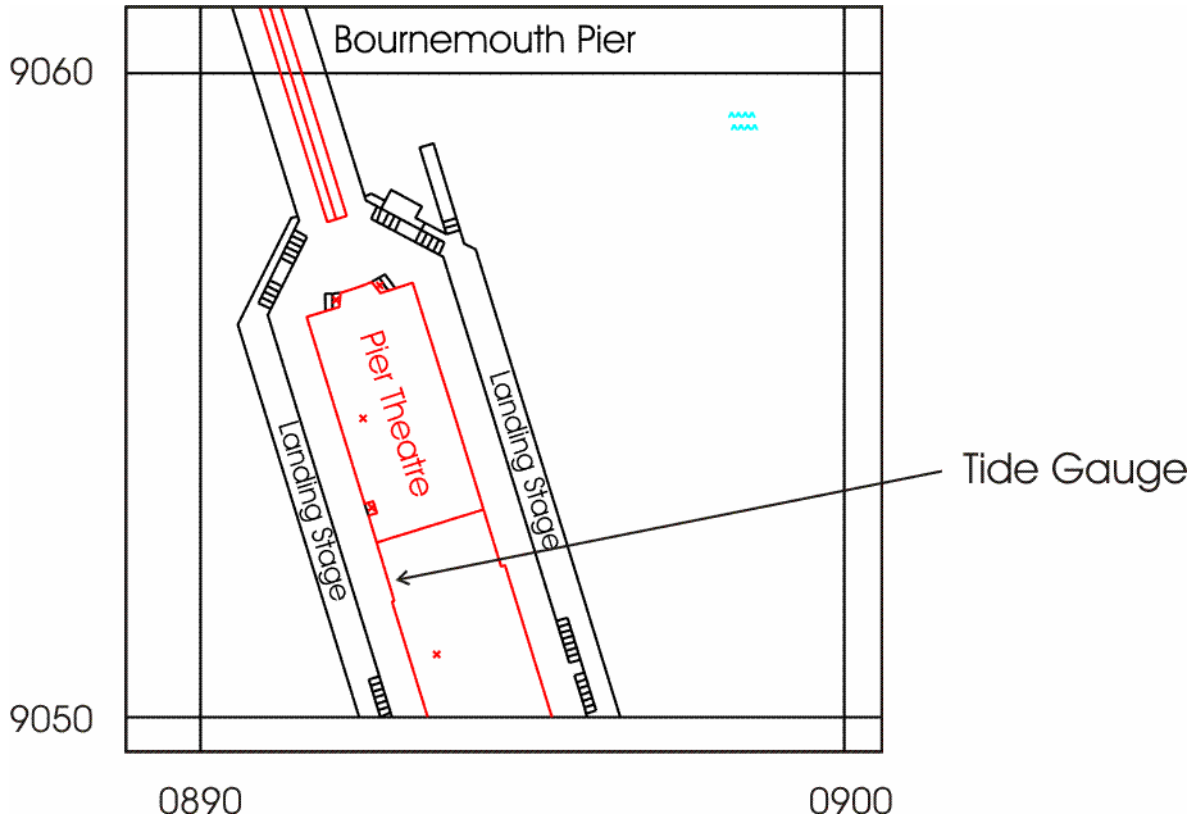
Site visits

Day 310 Carried out general maintenance

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	003,036,045,100,107-109,116,305

Bournemouth – Map & Images of Site



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Bournemouth – Statistics

Surge maxima	Value	Day	Time
January	0.369	4	09:00:00
February	0.094	19	11:45:00
March	0.165	7	23:30:00
April	0.689	25	16:45:00
May	0.3	9	22:45:00
June	0.606	7	17:00:00
July	0.325	7	17:45:00
August	0.354	15	19:00:00
September	0.38	24	06:15:00
October	0.583	17	04:15:00
November	0.522	25	00:15:00
December	0.581	25	09:15:00

Surge minima	Value	Day	Time
January	-0.378	6	22:00:00
February	-0.552	5	10:30:00
March	-0.41	11	13:15:00
April	-0.216	6	05:30:00
May	-0.307	12	16:15:00
June	-0.216	23	02:30:00
July	-0.179	23	01:45:00
August	-0.189	31	23:45:00
September	-0.235	6	14:30:00
October	-0.224	28	04:15:00
November	-0.36	23	07:45:00
December	-0.323	8	09:15:00

Extreme maxima	Value	Day	Time
January	2.385	24	09:15:00
February	2.212	23	09:30:00
March	2.262	10	09:45:00
April	2.633	9	22:45:00
May	2.547	7	21:30:00
June	2.691	7	23:00:00
July	2.457	5	21:45:00
August	2.497	3	21:30:00
September	2.504	17	21:30:00
October	2.919	17	09:30:00
November	2.521	16	10:00:00
December	2.915	14	09:00:00

Extreme minima	Value	Day	Time
January	0.24	11	17:00:00
February	-0.049	10	17:30:00
March	-0.092	10	17:00:00
April	0.136	8	16:30:00
May	0.312	7	04:00:00
June	0.314	5	03:45:00
July	0.359	22	05:30:00
August	0.418	21	05:30:00
September	0.277	1	03:45:00
October	0.459	16	15:45:00
November	0.292	15	16:30:00
December	0.506	13	15:15:00

Mean sea level	Days	MSL
January	28	1.528
February	29	1.361
March	31	1.412
April	21	1.612
May	31	1.572
June	30	1.633
July	31	1.619
August	31	1.673
September	30	1.639
October	30	1.738
November	29	1.728
December	31	1.706
	Sum	Avg
	352	1.602

Cromer – Tide Gauge Information

Latitude 52° 56' 03.7" N **Longitude** 01° 18' 05.9" E **Grid Ref** TG 2198 4254

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** Within Cromer lifeboat station

Measuring Points Attached to a leg of the lifeboat slipway

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	TG 2193 4233	S Steel bolt on top of wall opposite E side of pier
Aux1	TG 2198 4253	Rivet on steps of catwalk NE angle of LB station
Aux2	TG 2195 4233	S Steel bolt bottom ramp S side at W corner

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.75m below Ordnance Datum Newlyn

TGZ = 10.117m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 020 Installed S500 logger, migrated to Swantel telemetry system and carried out general maintenance

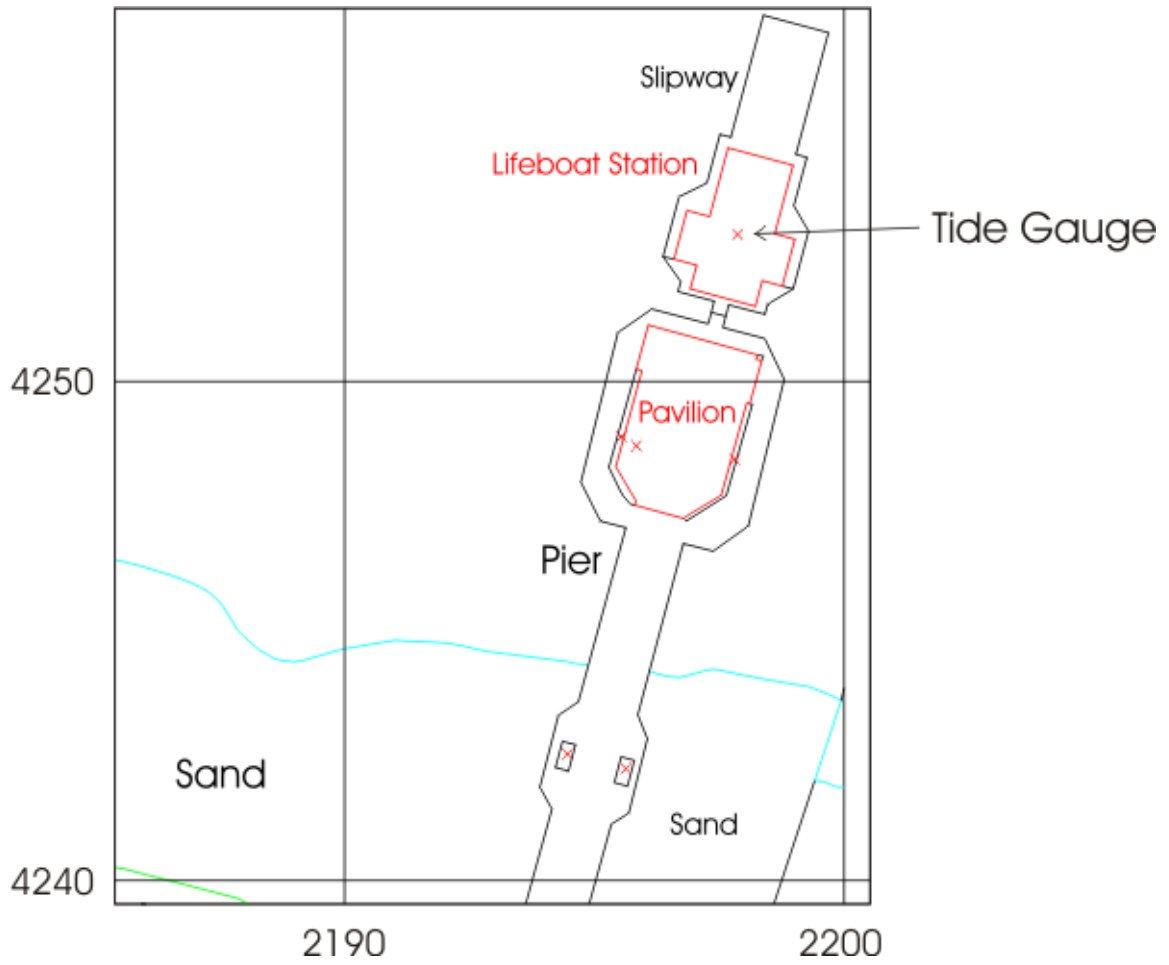
Day 185 Carried out general maintenance

Day 355 Repairs and survey to check fixings for new direct reading underwater transducer

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	013,020,039,046,061,065,095-096,119-120,213,288,291-323,326-342,344-354

Cromer – Map & Images of Site



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Cromer – Statistics

Surge maxima	Value	Day	Time
January	1.329	5	21:15:00
February	0.818	19	01:15:00
March	0.679	7	15:15:00
April	0.321	9	05:45:00
May	0.566	14	11:00:00
June	0.275	4	10:30:00
July	0.295	19	13:45:00
August	0.818	30	14:45:00
September	0.82	14	14:15:00
October	0.402	9	03:15:00
November	0.562	21	18:15:00
December	0.751	29	23:00:00

Surge minima	Value	Day	Time
January	-0.719	26	02:15:00
February	-0.882	4	23:45:00
March	-0.728	7	04:15:00
April	-0.6	17	12:00:00
May	-0.421	12	21:15:00
June	-0.311	29	13:00:00
July	-0.252	22	17:00:00
August	-0.504	27	23:00:00
September	-0.438	30	12:30:00
October	-0.271	16	13:30:00
November	-0.806	22	22:15:00
December	-0.875	28	15:45:00

Extreme maxima	Value	Day	Time
January	5.524	12	20:15:00
February	5.452	24	20:15:00
March	5.46	10	20:00:00
April	5.392	9	08:00:00
May	5.283	6	18:15:00
June	5.196	7	08:00:00
July	5.299	6	07:45:00
August	5.332	4	07:30:00
September	5.588	19	08:00:00
October	5.394	16	19:00:00
November	5.336	16	07:30:00
December	5.328	29	19:15:00

Extreme minima	Value	Day	Time
January	0.034	26	03:15:00
February	0.086	11	03:15:00
March	0.154	9	01:45:00
April	0.297	8	02:00:00
May	0.417	8	02:15:00
June	0.506	8	16:00:00
July	0.574	22	15:15:00
August	0.608	3	14:00:00
September	0.412	30	13:15:00
October	0.3	16	13:30:00
November	0.69	16	02:00:00
December	0.066	15	02:00:00

Mean sea level	Days	MSL
January	28	2.948
February	28	2.802
March	28	2.847
April	25	2.946
May	31	2.929
June	30	2.916
July	29	2.951
August	30	2.985
September	30	3.046
October	13	*
November	0	*
December	12	*
	Sum	Avg
	284	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Devonport (Plymouth) – Tide Gauge Information

Latitude 50° 22' 06.2" N **Longitude** 04° 11' 06.9" W **Grid Ref** SX 4469 5434

Instrument Data acquisition system with two full-tide bubbler gauges
Location **Tide Gauge Building** No. 1 Jetty in Devonport Royal Naval base
Measuring Points Attached to the stilling well beneath the building

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SX 4468 5434	Bolt on jetty wall. 6.6m NW angle T G building
Aux1	SX 4471 5433	Building N face NE angle
Aux2	SX 4487 5425	Bldg NW face W angle
Aux3	SX 4501 5454	Fl Br 11818 bldg W face NW angle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 3.22m below ODN

TGZ = 7.631m below TGBM

Levelling No levelling was carried out in 2012

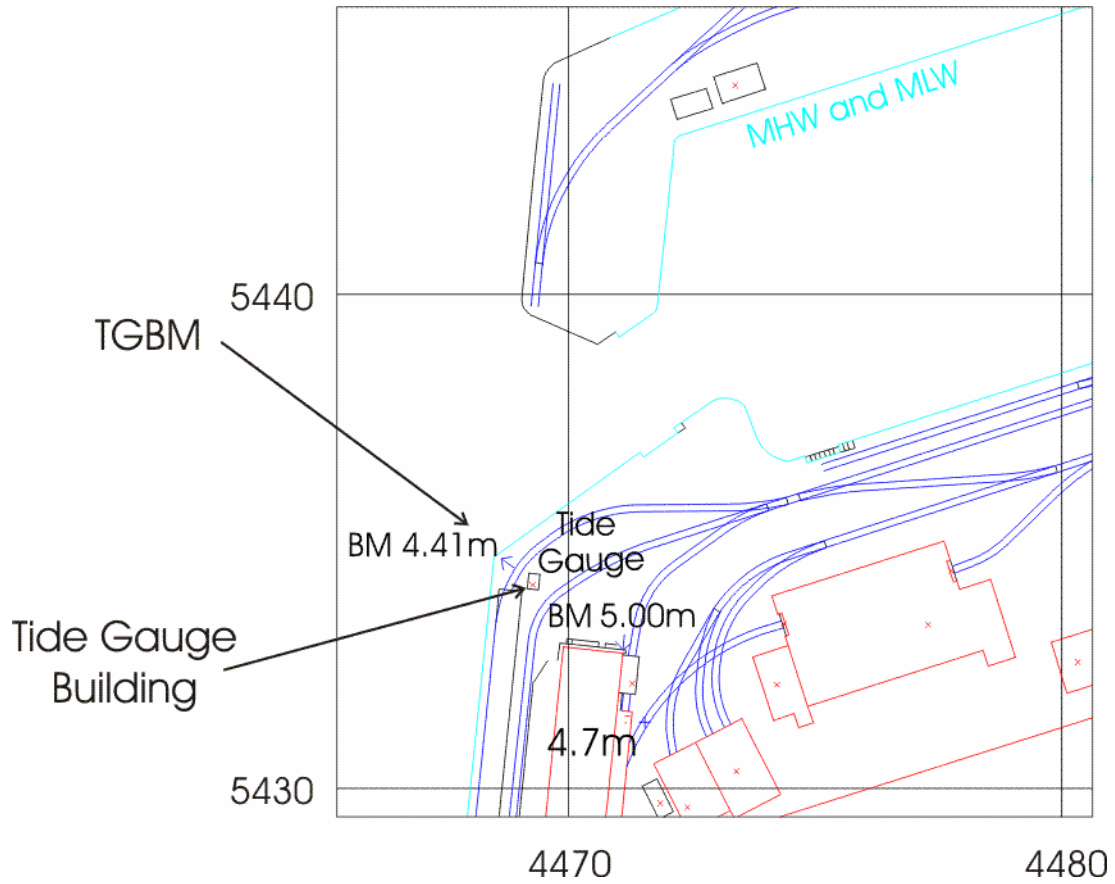
Site visits

Day 255 Carried out general maintenance and replaced failed compressor

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031,270	053,073,242-254

Devonport (Plymouth) – Map & Images of Site



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Devonport (Plymouth) – Statistics

Surge maxima	Value	Day	Time
January	0.329	3	06:45:00
February	0.014	1	06:15:00
March	0.162	31	18:45:00
April	0.707	25	14:30:00
May	0.314	9	23:45:00
June	0.714	7	14:30:00
July	0.394	7	02:15:00
August	0.465	15	11:00:00
September	0.317	23	23:15:00
October	0.519	17	07:15:00
November	0.495	24	20:45:00
December	0.507	14	12:15:00

Surge minima	Value	Day	Time
January	-0.35	10	14:30:00
February	-0.478	13	17:00:00
March	-0.388	11	15:00:00
April	-0.154	6	02:15:00
May	-0.306	12	17:45:00
June	-0.144	23	04:45:00
July	-0.142	22	04:45:00
August	-0.105	10	11:00:00
September	-0.147	14	00:00:00
October	-0.22	28	05:00:00
November	-0.196	6	18:45:00
December	-0.381	8	10:30:00

Extreme maxima	Value	Day	Time
January	5.694	25	07:00:00
February	5.588	10	07:15:00
March	5.701	10	07:00:00
April	6.044	9	19:45:00
May	5.967	7	18:45:00
June	6.013	7	20:00:00
July	5.854	5	19:00:00
August	5.888	3	18:45:00
September	5.874	17	18:30:00
October	6.287	17	06:30:00
November	5.883	16	07:00:00
December	6.241	14	06:00:00

Extreme minima	Value	Day	Time
January	0.607	12	14:00:00
February	0.328	11	02:00:00
March	0.076	10	13:30:00
April	0.259	8	13:00:00
May	0.572	7	00:15:00
June	0.642	5	00:00:00
July	0.711	6	01:30:00
August	0.711	21	02:00:00
September	0.512	18	01:00:00
October	0.737	16	12:15:00
November	0.527	15	12:45:00
December	0.85	15	13:15:00

Mean sea level	Days	MSL
January	31	3.337
February	29	3.177
March	31	3.228
April	30	3.462
May	31	3.388
June	30	3.449
July	31	3.417
August	27	3.492
September	19	3.461
October	31	3.565
November	30	3.551
December	31	3.520
	Sum	Avg
	351	3.421

Dover – Tide Gauge Information

Latitude 51° 06' 51.8" N **Longitude** 01° 19' 21.6" E **Grid Ref** TR 3265 4026

Instrument Data acquisition system with two full tide and a mid-tide bubbler gauge
Location **Tide Gauge Building** Prince of Wales Pier, Western Dock (just before the lighthouse)
Measuring Points Attached to the stilling well

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	TR 3193 4074	Fl Br G4868 building. East side of works entrance
Aux 1	TR 3195 4095	No 29 Waterloo Crescent SW face S angle
Aux 2	TR 3228 4053	Rivet pier wall NE side of pier F junction
Aux 3	TR 3265 4026	Rivet steps NE side P of W pier 1.0M SE W angle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 3.67m below Ordnance Datum Newlyn (ODN)
 TGZ = 10.491m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 026 Installed S500 logger, migrated to Swantel telemetry system
 Day 038 Repaired compressor

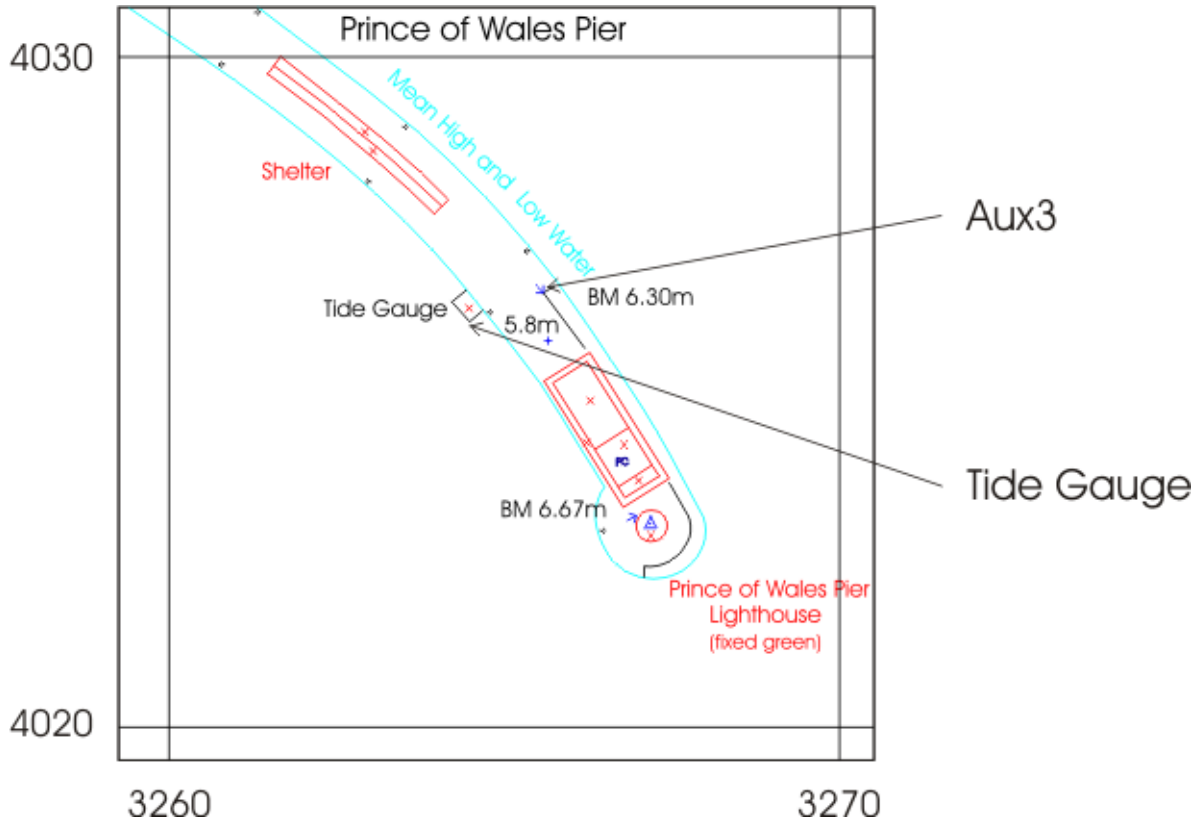
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
94%	15 minutes	025-031,352-366	053-058,151-157,181,183,187-352

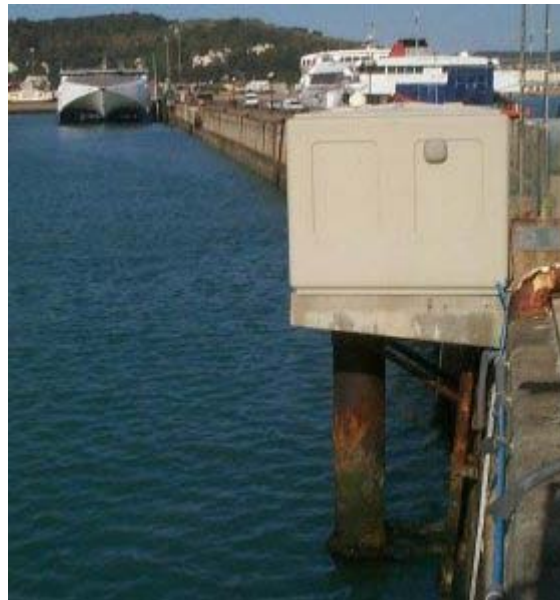
Notes on Completeness/Quality

Communication with outstation failed while there was no access to pier due to harbour works.

Dover – Map & Images of Site



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Dover – Statistics

Surge maxima	Value	Day	Time
January	1.227	5	17:15:00
February	0.559	19	09:00:00
March	0.512	7	19:30:00
April	0.51	18	06:15:00
May	0.374	15	19:00:00
June	0.437	7	22:30:00
July	0.32	19	18:30:00
August	0.22	15	19:15:00
September			
October	0.364	14	23:15:00
November	-0.234	19	16:45:00
December			

Surge minima	Value	Day	Time
January	-0.581	6	18:30:00
February	-0.966	20	09:15:00
March	-0.742	7	09:45:00
April	-0.403	17	13:45:00
May	-0.411	12	13:30:00
June	-0.35	8	13:45:00
July	-0.221	22	18:00:00
August	-0.112	10	20:30:00
September			
October	-0.161	12	20:30:00
November	-0.375	19	14:45:00
December			

Extreme maxima	Value	Day	Time
January	7.149	13	01:00:00
February	6.793	14	03:00:00
March	7.105	11	00:30:00
April	7.092	7	23:30:00
May	7.01	6	23:00:00
June	6.919	7	13:00:00
July	6.896	5	12:00:00
August	6.158	16	10:15:00
September			
October	7.114	16	23:15:00
November	5.844	19	15:00:00
December			

Extreme minima	Value	Day	Time
January	0.579	25	07:30:00
February	0.273	10	08:00:00
March	0.254	9	06:45:00
April	0.371	8	07:15:00
May	0.464	8	07:30:00
June	0.703	6	07:15:00
July	0.72	6	20:15:00
August	2.153	8	08:00:00
September			
October	4.236	14	07:30:00
November	4.59	19	13:00:00
December			

Mean sea level	Days	MSL
January	29	3.801
February	22	3.564
March	31	3.615
April	30	3.771
May	29	3.733
June	21	3.734
July	4	*
August	0	*
September	0	*
October	0	*
November	0	*
December	0	*
	Sum	Avg
	166	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Fishguard – Tide Gauge Information

Latitude 52° 00' 47.6" N **Longitude** 04° 59' 01.5" W **Grid Ref** SM 9534 3918

Instrument Data acquisition system with two full tide and a mid-tide bubbler gauge
Location **Tide Gauge Building** On Fishguard Quay, adjacent to the RNLI station
Measuring Points Approximately 10m from the end of the quay

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SM 9534 3918	OSBM bolt on quay 3.6M NE end of railings (1987)
Aux1	SM 9513 3874	OS bolt con base railings 6.4M NW angle TG hut
Aux2	SM 9489 3849	Rivet step top of Goodwick Quay
Aux3	SM 9455 3820	Fl Br 11518 blding SW side railway bridge SE Face

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.44m below ODN

TGZ = 7.88m below TGBM

Levelling No levelling was carried out in 2012

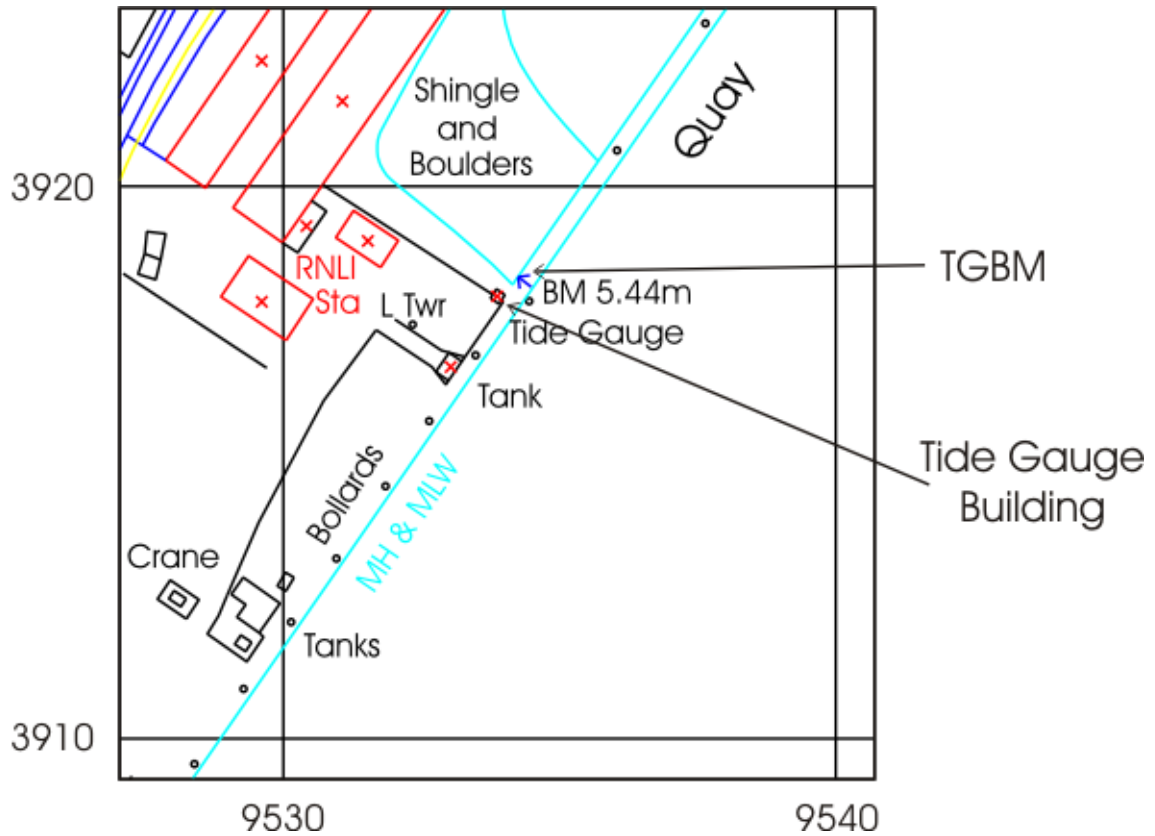
Site visits

No site visits in 2012

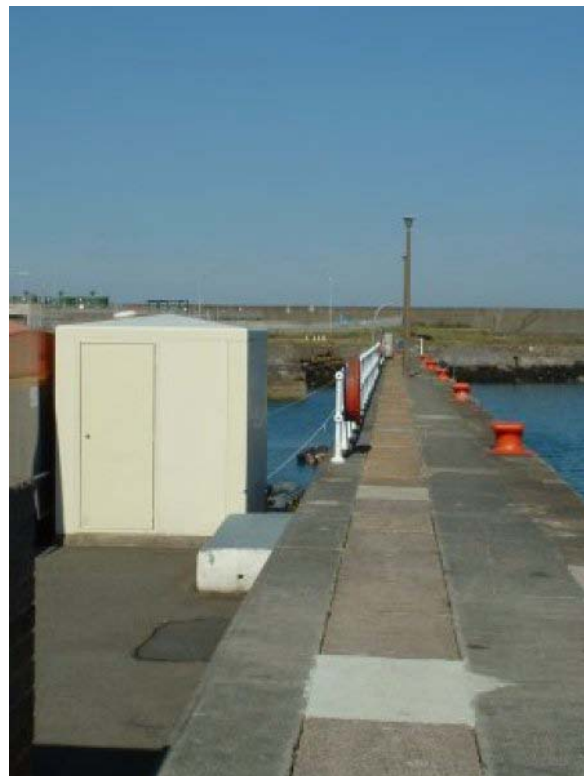
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	034,042,049,073-075,199-200,231-233,318

Fishguard – Map & Images of Site



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Fishguard – Statistics

After a site visit in 2013, it was discovered that both full-tide channels were silted up. Consequently, all the data for the primary channel at this site were flagged as suspect and no statistics could be produced for 2012.

Harwich – Tide Gauge Information

Latitude 51° 56' 52.8" N **Longitude** 01° 17' 31.7" E **Grid Ref** TM 2634 3284

Instrument Data acquisition system with two full tide and a mid-tide bubbler gauge
Location **Tide Gauge Building** Seaward end of Harwich Haven Authority jetty
Measuring Points On the jetty, directly below the tide gauge cabinet

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	TM 2634 3284	Bolt at base of flag staff
Aux1	TM 2617 3277	Cut mark quay edge
Aux2	TM 2608 3271	Cut mark NW face of Bank building
Aux3	TM 2610 3258	Cut mark N side of ent St Nicholas's church

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.02m below ODN

TGZ = 6.17m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 041 Installed S500 logger, migrated to Swantel telemetry system and replaced compressor

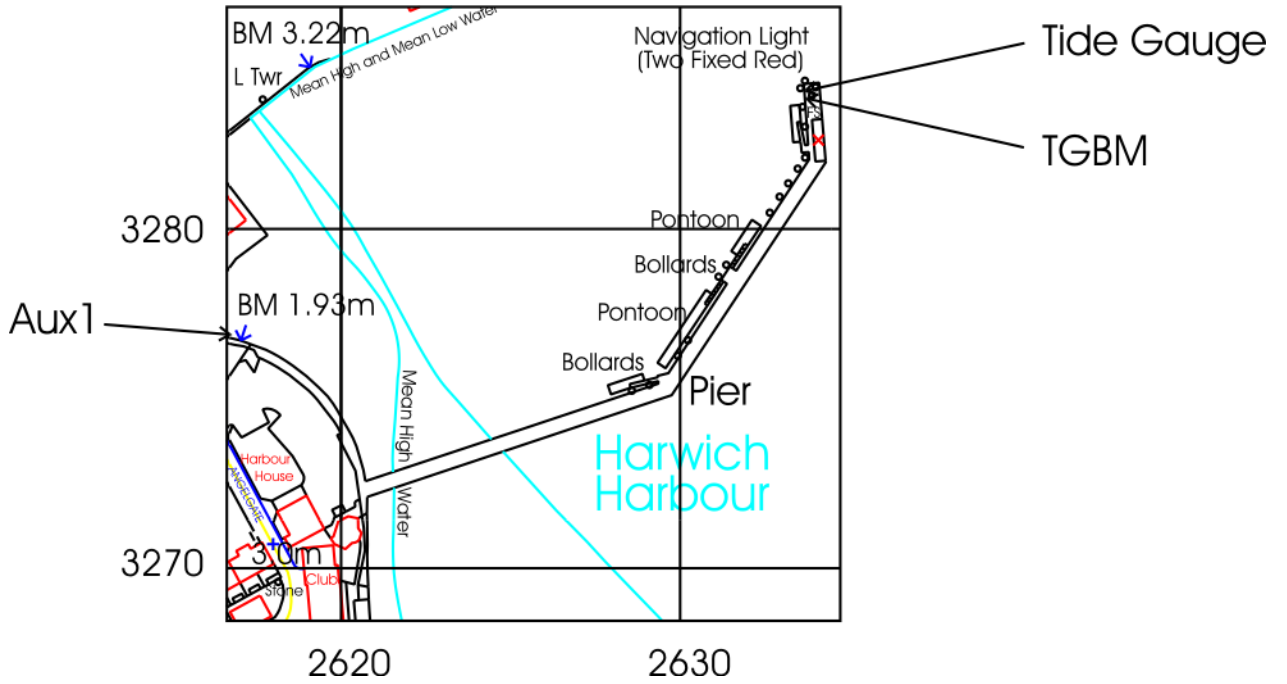
Day 168 Inspected enabling works and cleared blocked channel

Day 284 Diving to clear blockage; upgraded telemetry outstation hardware

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
98%	15 minutes	040-045,065	057,099-100,114-116,156,168,257-266,268-269,271

Harwich – Map & Images of Site



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Harwich – Statistics

Surge maxima	Value	Day	Time
January	1.504	5	18:15:00
February	0.772	19	05:30:00
March	0.657	7	21:00:00
April	0.482	28	22:45:00
May	0.497	15	16:15:00
June	0.42	4	06:30:00
July	0.398	14	07:30:00
August	0.597	30	18:15:00
September	0.458	13	03:00:00
October	0.801	27	04:45:00
November	0.55	4	12:00:00
December	0.877	9	22:30:00

Surge minima	Value	Day	Time
January	-0.715	4	21:30:00
February	-0.737	4	23:15:00
March	-0.705	7	12:00:00
April	-0.509	17	10:00:00
May	-0.454	13	03:45:00
June	-0.542	8	15:30:00
July	-0.306	18	12:30:00
August	-0.429	28	03:00:00
September	-0.544	30	18:45:00
October	-0.48	16	08:00:00
November	-0.813	25	10:00:00
December	-0.82	28	20:00:00

Extreme maxima	Value	Day	Time
January	4.541	5	19:45:00
February	4.238	25	01:30:00
March	4.217	7	23:30:00
April	4.423	11	02:30:00
May	4.281	9	01:30:00
June	4.335	7	01:15:00
July	4.32	6	01:00:00
August	4.321	30	23:15:00
September	4.304	2	12:45:00
October	4.551	17	00:15:00
November	4.358	15	12:15:00
December	4.537	16	13:30:00

Extreme minima	Value	Day	Time
January	-0.147	26	07:30:00
February	0.057	9	06:15:00
March	-0.101	9	06:00:00
April	0.161	6	04:45:00
May	0.162	8	06:45:00
June	0.041	8	20:30:00
July	0.188	22	19:45:00
August	0.244	3	18:30:00
September	0.091	30	17:45:00
October	0.25	16	17:45:00
November	0.398	14	17:30:00
December	-0.003	15	06:15:00

Mean sea level	Days	MSL
January	31	2.181
February	22	2.014
March	31	2.052
April	22	2.154
May	31	2.140
June	30	2.138
July	31	2.170
August	31	2.208
September	15	2.212
October	31	2.272
November	30	2.272
December	31	2.173
	Sum	Avg
	336	2.166

Heysham – Tide Gauge Information

Latitude 54° 01' 54.6" N **Longitude** 02° 55' 12.9" W **Grid Ref** SD 3982 5993

Instrument Data acquisition system with two full tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** South side of the entrance to Heysham harbour

Measuring Points Heysham harbour

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SD 4030 6012	OSBM bolt on south quay 40.8m SW from SE angle of dock
Aux1	SD 4141 6005	Bridge parapet, E side of road
Aux2	SD 4026 6033	Pivot pin harbour wall 6.1M SW N angle of harbour
Aux3	SD 4026 6033	Rivet harbour wall 5.7M SW of N angle of Harbour
Aux4	SD 3982 5992	Brass bolt quay edge

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 4.90m below Ordnance Datum Newlyn (ODN)

TGZ = 12.098m below TGBM

Levelling No levelling was carried out in 2012

Site visits

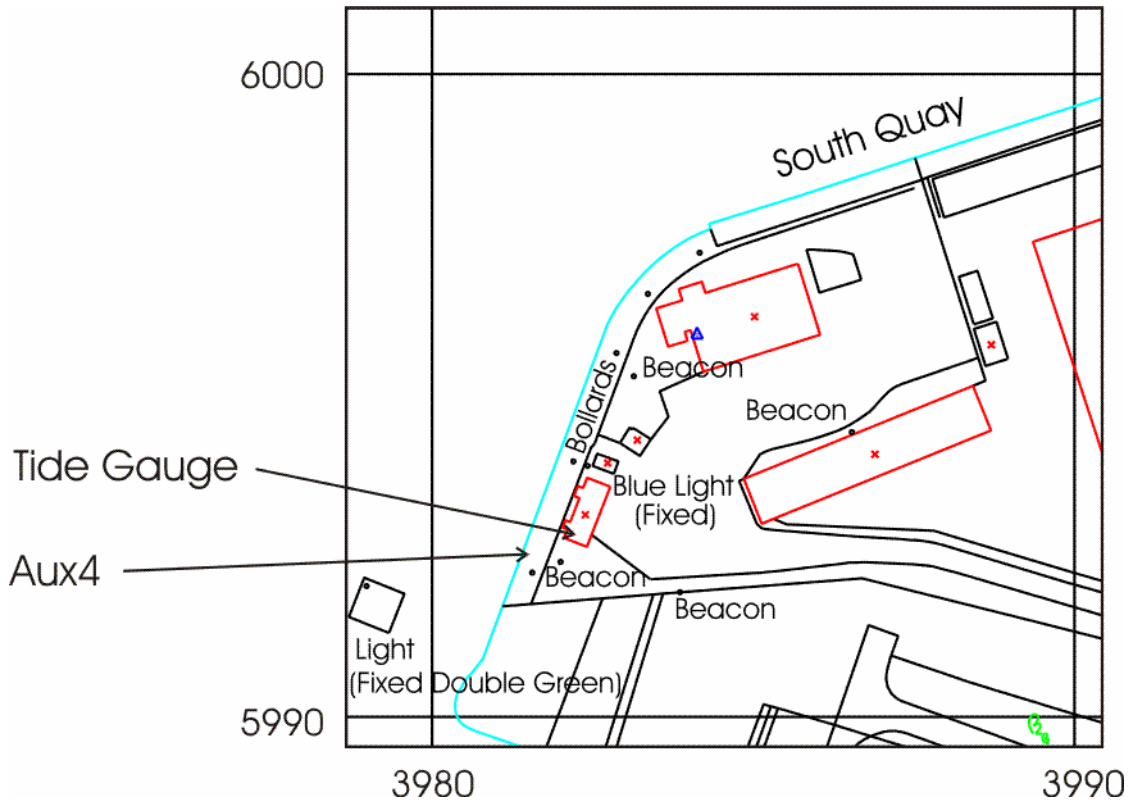
Day 117 Carried out general maintenance

Day 305 Investigated communications fault (BT line had been damaged)

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	032,057,118-129,133-151,164-174,183-184,188-213,218-226,251,253

Heysham – Map & Images of Site



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Heysham – Statistics

Surge maxima	Value	Day	Time
January	1.615	3	12:45:00
February	0.654	18	08:45:00
March	0.506	7	06:30:00
April	0.812	17	05:45:00
May	0.436	10	18:15:00
June	0.633	15	17:15:00
July	0.366	1	06:30:00
August	0.722	15	18:30:00
September	0.543	14	03:15:00
October	0.846	17	16:00:00
November	0.79	19	11:45:00
December	0.885	29	03:45:00

Surge minima	Value	Day	Time
January	-0.473	12	19:45:00
February	-0.678	14	00:00:00
March	-0.465	12	23:00:00
April	-0.829	4	18:45:00
May	-0.265	12	01:15:00
June	-0.302	3	17:00:00
July	-0.034	6	06:30:00
August	-0.315	30	13:00:00
September	-0.281	24	01:00:00
October	-0.443	27	01:30:00
November	-0.566	27	13:00:00
December	-0.608	7	16:30:00

Extreme maxima	Value	Day	Time
January	10.095	25	12:30:00
February	10.193	22	11:45:00
March	10.238	9	11:45:00
April	10.531	10	01:00:00
May	10.144	9	01:00:00
June	10.207	6	00:00:00
July	10.15	4	23:45:00
August	10.247	4	00:15:00
September	10.473	18	00:00:00
October	10.777	17	12:00:00
November	10.271	16	12:30:00
December	10.639	14	23:45:00

Extreme minima	Value	Day	Time
January	0.823	12	20:00:00
February	0.443	10	19:45:00
March	0.196	10	19:15:00
April	0.317	7	18:15:00
May	0.833	9	07:45:00
June	0.793	5	05:45:00
July	0.845	5	06:30:00
August	0.99	21	08:00:00
September	0.773	19	07:30:00
October	0.782	17	06:15:00
November	0.692	15	06:15:00
December	0.961	14	06:00:00

Mean sea level	Days	MSL
January	31	5.207
February	29	4.984
March	31	5.017
April	25	5.148
May	3	*
June	21	5.229
July	2	*
August	21	5.309
September	30	5.260
October	31	5.332
November	30	5.338
December	31	5.318
	Sum	Avg
	285	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Hinkley Point – Tide Gauge Information

Latitude 51° 12' 38.2" N **Longitude** 03° 07' 52.8" W **Grid Ref** ST 2107 4632

Instrument Datarang system with dual underwater pressure transducers
Location **Tide Gauge Building** Hinkley Point "A" power station
Measuring Points Underwater vented chambers suspended from a steel pole attached to a water intake tower (400m offshore)

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	ST 2104 4634	Bolt on wall 0.962m NE of SE corner of steps
Aux1	ST 2078 4626	Rivet on sea wall 41.28m SW of corner of outfall
Aux2	ST 2094 4631	Bolt on sea wall 31.245m SW of end of railings
Aux3	ST 2123 4634	Bolt sea defence wall

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 5.80m below Ordnance Datum Newlyn (ODN)
 TGZ = 14.639m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 101-103 Carried out electrical enabling work and migrated to Swantel telemetry system

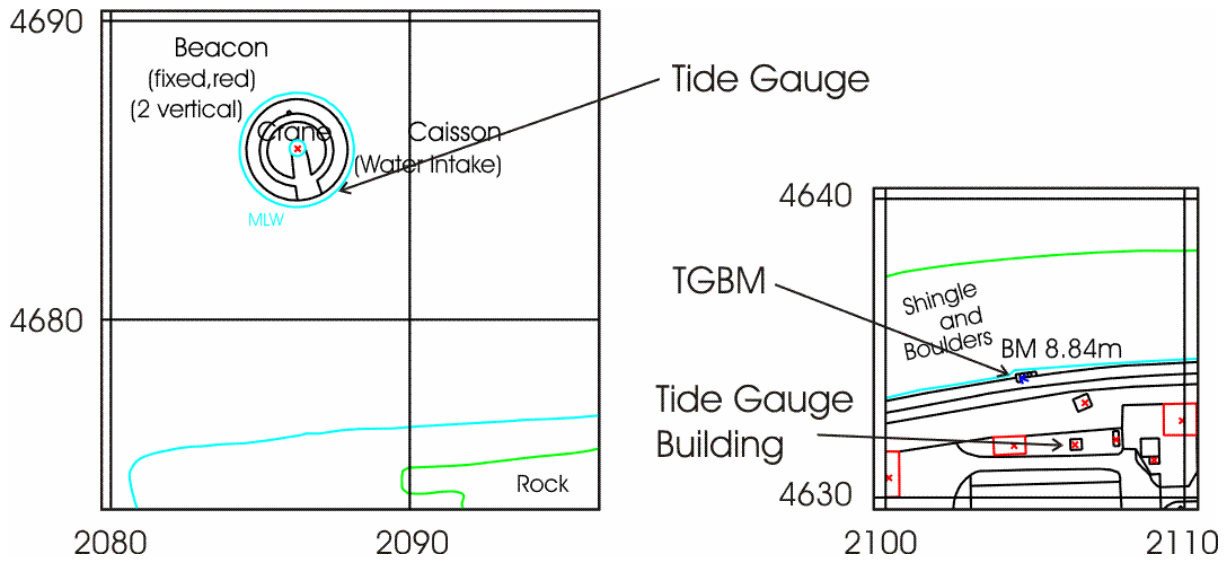
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	130-131,171	001-130,131-171,172-335

Notes on Completeness/Quality

The clock in the DATARING logger exhibited clock drift and would not respond to remote commands to correct the error. Consequently, the data were flagged as suspect. The issue was resolved upon installation of a new S500 logger in April 2012.

Hinkley Point – Map & Images of Site



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Hinkley Point – Statistics

No statistics could be calculated as all data for the primary channel was subsequently flagged as unreliable for the purposes of long-term sea level monitoring. The secondary channel was generally functional during this time.

Holyhead – Tide Gauge Information

Latitude 53° 18' 50.2" N **Longitude** 04° 37' 13.6" W **Grid Ref** SH 2553 8287

Instrument Data acquisition system with a full-tide and a mid-tide bubbler gauge, with a back-up Munro float gauge

Location **Tide Gauge Building** Salt Island jetty, close to the old harbour lighthouse
Measuring Points As above

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SH 2553 8287	Bolt on concrete foundation, north side of tide gauge building
Aux1	SH 2556 8289	Cut mark lighthouse
Aux3	SH 2506 8292	Bolt Salt Island bridge

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 3.05m below Ordnance Datum Newlyn (ODN)
 TGZ = 7.436m below TGBM

Levelling Site was levelled on Day 173

Site visits

Day 081 Carried out general maintenance
 Day 173 Calibrated gauge equipment
 Day 304 Upgraded telemetry outstation hardware
 Day 334 Investigated report of water in the building
 Day 340 Met with Port Engineers to survey building

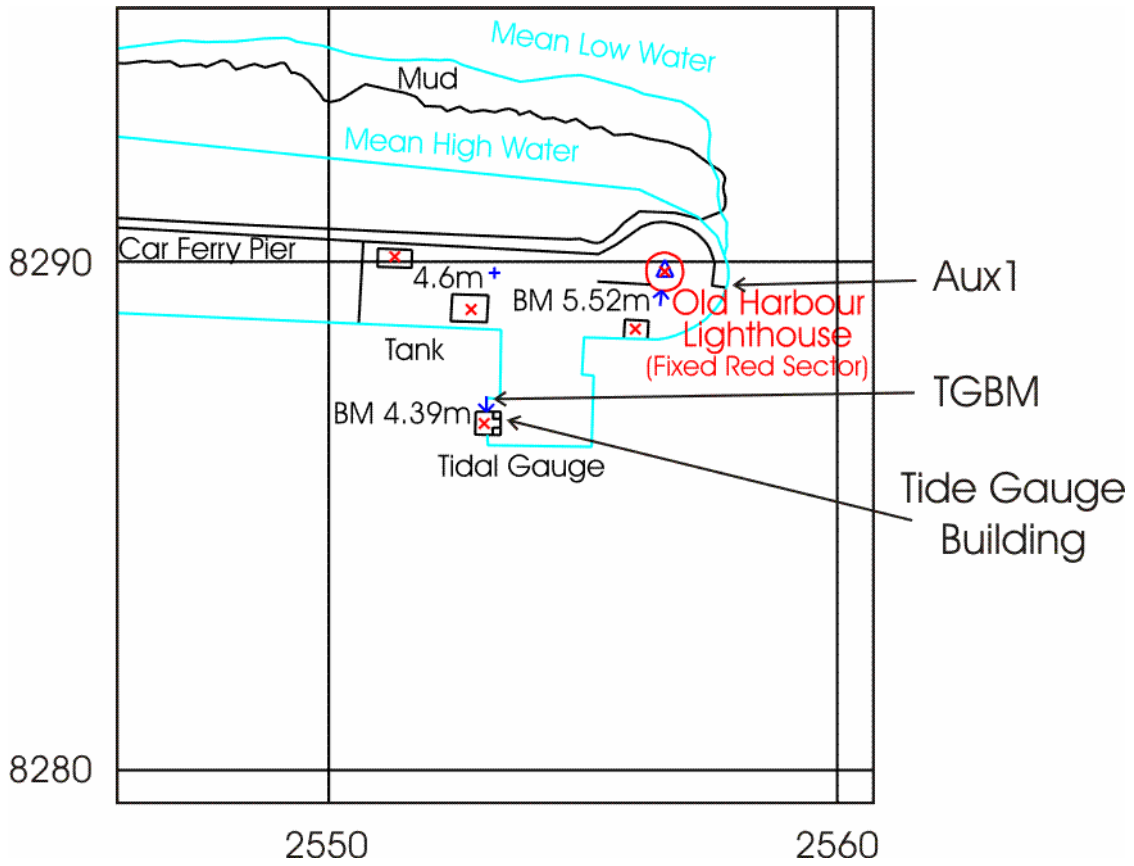
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031,091	001-031,031-081,081-174,304,334

Notes on Completeness/Quality

Following migration to Swantel, Channel 2 was reading 75mm high. TGI adjusted the instrumentation in November 2011 and March 2012 but the issue recurred. The gauge was therefore re-levelled during June 2012, resolving the problem.

Holyhead – Map & Images of Site



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Holyhead – Statistics

Surge maxima	Value	Day	Time
January			
February			
March			
April			
May			
June	0.329	29	00:45:00
July	0.193	4	05:45:00
August	0.593	15	16:45:00
September	0.228	25	15:45:00
October	0.62	17	14:15:00
November	0.652	22	11:15:00
December	0.634	29	02:45:00

Surge minima	Value	Day	Time
January			
February			
March			
April			
May			
June	-0.1	25	01:45:00
July	-0.173	25	17:30:00
August	-0.244	30	12:00:00
September	-0.231	5	17:45:00
October	-0.287	27	04:00:00
November	-0.465	27	12:00:00
December	-0.444	5	11:15:00

Extreme maxima	Value	Day	Time
January			
February			
March			
April			
May			
June	5.521	24	00:45:00
July	6.017	4	22:45:00
August	6.098	3	23:15:00
September	6.161	17	23:00:00
October	6.458	17	11:15:00
November	6.014	16	11:45:00
December	6.343	15	11:15:00

Extreme minima	Value	Day	Time
January			
February			
March			
April			
May			
June	1.05	23	06:30:00
July	0.523	6	05:45:00
August	0.552	31	03:45:00
September	0.398	19	06:00:00
October	0.586	16	16:30:00
November	0.396	15	17:00:00
December	0.666	15	17:30:00

Mean sea level	Days	MSL
January	0	*
February	0	*
March	0	*
April	0	*
May	0	*
June	8	*
July	31	3.266
August	31	3.349
September	30	3.301
October	31	3.399
November	30	3.399
December	31	3.401
	Sum	Avg
	192	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Ilfracombe – Tide Gauge Information

Latitude 51° 12' 40.1" N **Longitude** 04° 06' 44.6" W **Grid Ref** SS 5255 4789

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** North west corner of the car park, east of Lantern Hill

Measuring Points Seaward side of Ilfracombe pier at the harbour entrance

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SS 5263 4791	OSBM Bolt on concrete pier, south angle of tide gauge hut
Aux1	SS 5245 4782	Pier Hotel, The Quay
Aux2	SS 5251 4789	St Nicholas chapel N face 6.1m from NW angle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 4.80m below Ordnance Datum Newlyn (ODN)

TGZ = 12.379m below TGBM

TGZ = 10.76m below Aux1

TGZ = 32.541m below Aux2

Levelling No levelling was carried out in 2012

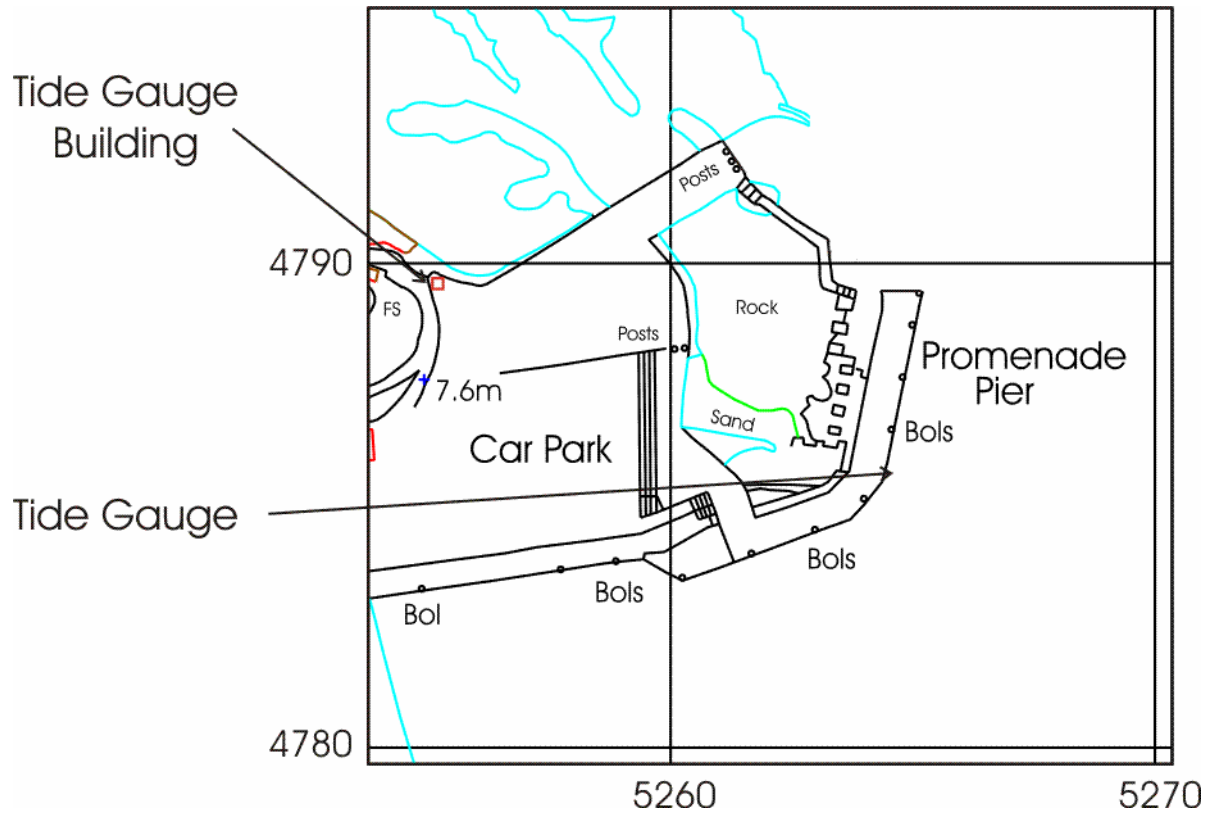
Site visits

Day 085 Met with EA representatives and upgraded telemetry outstation hardware

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	068,085-086,095-096,120

Ilfracombe – Map & Images of Site



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Ilfracombe – Statistics

Surge maxima	Value	Day	Time
January	0.732	3	03:30:00
February	0.213	22	10:00:00
March	0.293	7	09:15:00
April	0.725	25	15:30:00
May	0.392	9	23:30:00
June	0.591	8	04:45:00
July	0.359	13	20:15:00
August	0.704	15	12:30:00
September	0.381	26	08:15:00
October	0.662	17	11:00:00
November	0.692	22	14:30:00
December	0.647	14	14:45:00

Surge minima	Value	Day	Time
January	-0.319	5	13:30:00
February	-0.481	13	19:15:00
March	-0.352	11	17:00:00
April	-0.477	4	13:30:00
May	-0.22	12	07:00:00
June	-0.073	24	21:30:00
July	-0.087	17	05:30:00
August	-0.15	30	16:00:00
September	-0.192	5	07:00:00
October	-0.25	27	02:45:00
November	-0.311	27	14:00:00
December	-0.431	7	21:30:00

Extreme maxima	Value	Day	Time
January	9.537	25	07:15:00
February	9.459	10	07:30:00
March	9.762	10	07:15:00
April	10.026	9	07:30:00
May	9.963	7	18:45:00
June	9.741	5	18:30:00
July	9.679	5	19:15:00
August	9.779	3	19:00:00
September	9.919	17	18:45:00
October	10.36	17	06:45:00
November	9.82	15	06:30:00
December	10.023	14	06:15:00

Extreme minima	Value	Day	Time
January	0.87	24	00:15:00
February	0.281	10	13:30:00
March	-0.026	11	01:30:00
April	0.202	8	12:45:00
May	0.511	7	00:00:00
June	0.704	4	23:45:00
July	0.804	6	01:15:00
August	0.743	20	13:30:00
September	0.46	18	13:15:00
October	0.642	16	12:15:00
November	0.493	15	12:30:00
December	0.932	15	13:15:00

Mean sea level	Days	MSL
January	31	4.967
February	29	4.780
March	29	4.835
April	25	5.076
May	31	4.995
June	30	5.072
July	31	5.029
August	31	5.097
September	30	5.046
October	31	5.167
November	30	5.151
December	31	5.140
	Sum	Avg
	359	5.030

Immingham – Tide Gauge Information

Latitude 53° 37' 48.8" N **Longitude** 00° 11' 14.7" W **Grid Ref** TA 1996 1638

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge
Location **Tide Gauge Building** Entrance to Immingham Docks, east of the lock gates
Measuring Points Fixed to a leg of the lead-in jetty on the east side of the dock entrance

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	TA 1989 1630	Docks office, north angle, north east face
Aux1	TA 2005 1631	Customs house, east angle, north east face
Aux2	TA 1994 1640	Bolt on concrete base of tide gauge building
Aux3	TA 2000 1648	Stud in camera tower

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 3.90m below ODN

TGZ = 9.131m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 034 Migrated to Swantel telemetry system and decommissioned DATARING logger

Day 271 Upgraded telemetry outstation hardware and replaced compressor

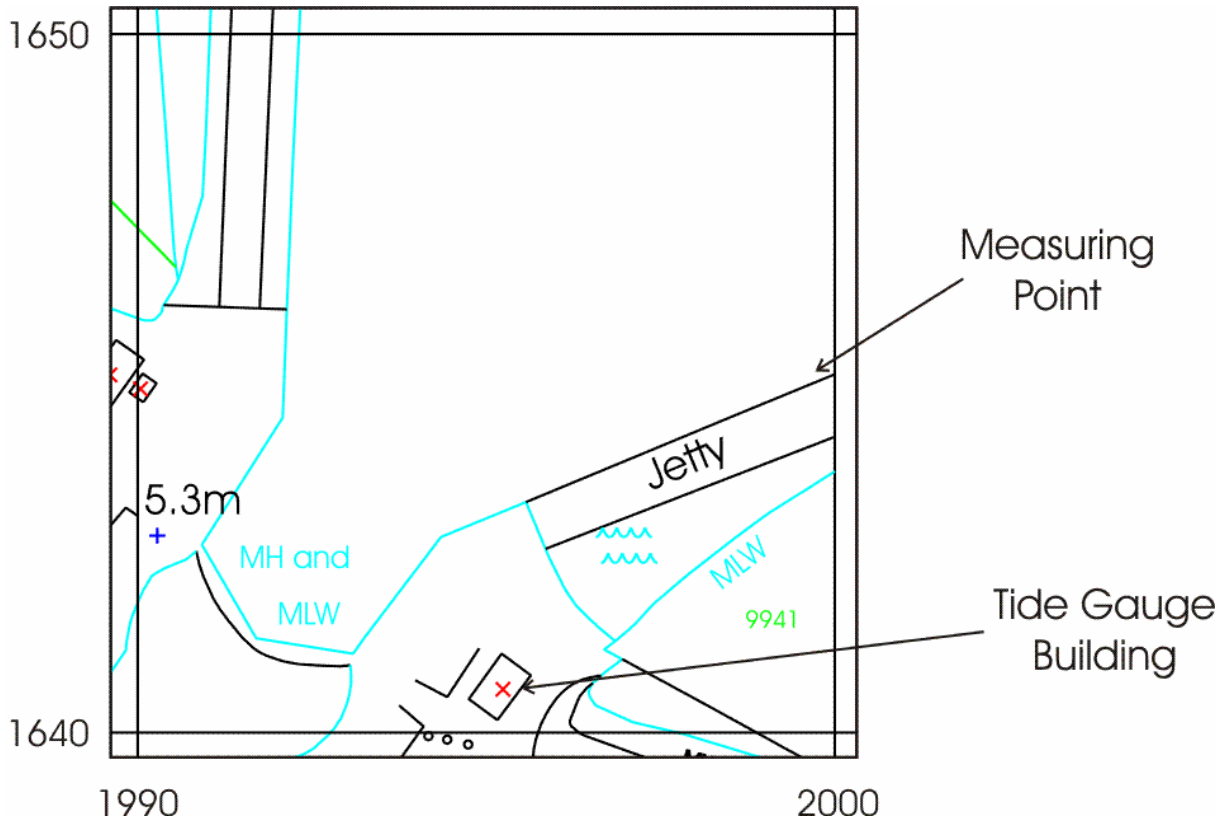
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
100%	15 minutes	None	001-033,036-271

Notes on Completeness/Quality

The primary channel was 25-30mm low, but the secondary channel was available. An investigation in February 2012 suggested the pressure points were blocking periodically due to siltation and a diving operation is required to clear this. However, due to dangerous diving conditions the Port Authority is currently reluctant to issue diving permits. TGI has designed alternative and more readily accessible steelwork for consideration by the Environment Agency.

Immingham – Map & Images of Site



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Immingham – Statistics

Surge maxima	Value	Day	Time
January	0.91	18	19:45:00
February	0.092	5	06:45:00
March			
April			
May			
June			
July			
August			
September	0.099	29	01:00:00
October	0.552	27	10:15:00
November	0.402	21	14:15:00
December	0.54	29	15:45:00

Surge minima	Value	Day	Time
January	-0.659	26	02:30:00
February	-0.756	4	22:15:00
March			
April			
May			
June			
July			
August			
September	-0.593	30	12:45:00
October	-0.601	16	13:00:00
November	-0.709	19	17:00:00
December	-0.886	23	12:45:00

Extreme maxima	Value	Day	Time
January	7.501	12	19:45:00
February	6.362	6	04:45:00
March			
April			
May			
June			
July			
August			
September	7.181	29	05:00:00
October	7.874	17	06:30:00
November	7.548	15	06:15:00
December	7.56	15	19:15:00

Extreme minima	Value	Day	Time
January	0.349	26	02:15:00
February	0.923	7	23:45:00
March			
April			
May			
June			
July			
August			
September	0.508	30	12:15:00
October	0.22	16	12:45:00
November	0.773	16	01:15:00
December	0.249	15	01:00:00

Mean sea level	Days	MSL
January	5	*
February	0	*
March	0	*
April	0	*
May	0	*
June	0	*
July	0	*
August	0	*
September	2	*
October	31	4.177
November	30	4.205
December	31	4.086
	Sum	Avg
	99	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Port Erin (Isle Of Man) – Tide Gauge Information

Latitude 54° 05' 07.4" N **Longitude** 04° 46' 05.0" W **Grid Ref** SC 1904 6904

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge
Location **Tide Gauge Building** Port Erin lifeboat station
Measuring Points Close to the end of the lifeboat slipway (the mid-tide pressure point is attached to a concrete leg of the boathouse)

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SC 1904 6901	Bolt SE corner of the RNLI boathouse
Aux 2		Bolt on seawall NW of Marine labs
Aux 3	SC 1928 6903	Bolt base of light tower Raglan pier

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 2.75m below Ordnance Datum Local (ODL)
 TGZ = 9.288m below TGBM

Levelling No levelling was carried out in 2012

Site visits

No site visits in 2012

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031,087,093-094	012,022,033,071,087,094

Port Erin (Isle Of Man) – Map & Images of Site

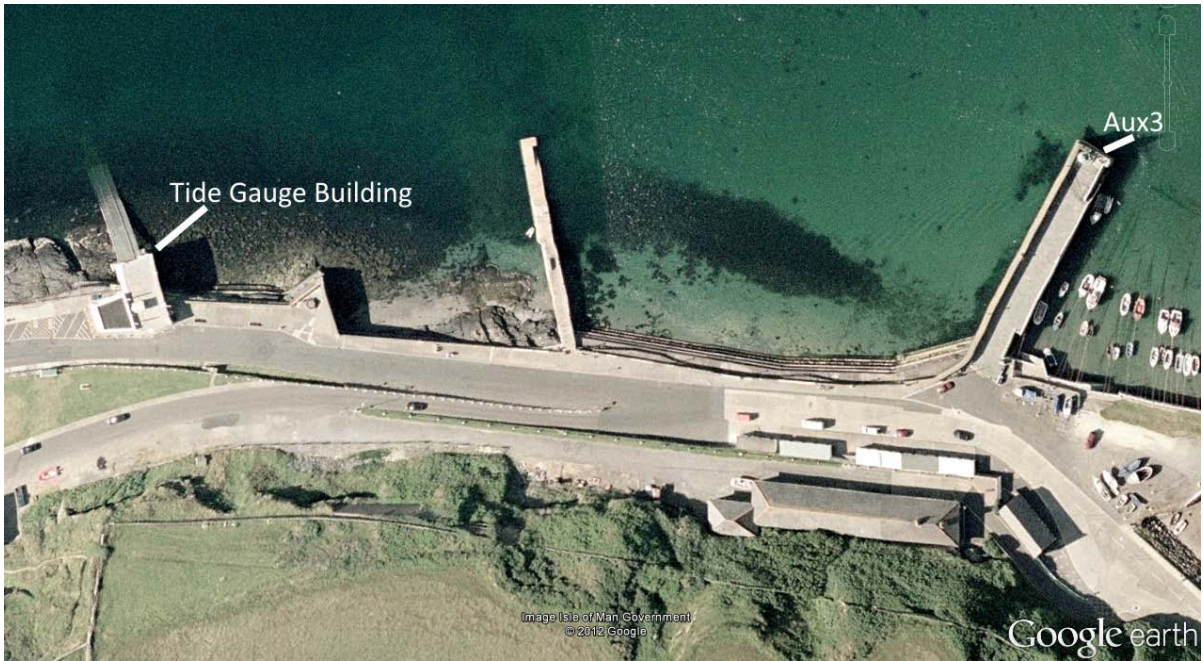


Image: Isle of Man Government ©Google 2012



Port Erin (Isle Of Man) – Statistics

Surge maxima	Value	Day	Time
January	1.163	3	10:30:00
February	0.364	22	15:30:00
March	0.306	7	04:30:00
April	0.543	17	06:00:00
May	0.356	13	21:45:00
June	0.452	15	16:00:00
July	0.209	4	05:30:00
August	0.633	15	20:15:00
September	0.277	30	10:00:00
October	0.635	17	16:30:00
November	0.702	19	11:00:00
December	0.724	29	04:00:00

Surge minima	Value	Day	Time
January	-0.448	5	18:30:00
February	-0.514	14	01:30:00
March	-0.349	5	13:45:00
April	-0.642	29	16:15:00
May	-0.233	12	02:00:00
June	-0.109	3	22:00:00
July	-0.143	21	01:45:00
August	-0.262	30	13:30:00
September	-0.201	5	13:15:00
October	-0.291	27	01:15:00
November	-0.458	27	10:30:00
December	-0.481	7	16:45:00

Extreme maxima	Value	Day	Time
January	5.734	25	12:30:00
February	5.617	22	11:45:00
March	5.574	9	11:45:00
April	5.833	9	12:45:00
May	5.761	8	00:00:00
June	5.692	7	00:45:00
July	5.622	4	23:45:00
August	5.716	4	00:15:00
September	5.782	18	00:00:00
October	6.116	17	12:15:00
November	5.675	19	15:00:00
December	6.011	15	00:00:00

Extreme minima	Value	Day	Time
January	0.103	12	19:30:00
February	-0.098	10	19:00:00
March	-0.235	10	18:45:00
April	-0.118	7	17:30:00
May	0.15	6	17:00:00
June	0.218	5	05:15:00
July	0.216	6	06:45:00
August	0.23	31	04:45:00
September	0.155	19	07:00:00
October	0.358	15	04:30:00
November	0.173	15	18:00:00
December	0.432	13	17:00:00

Mean sea level	Days	MSL
January	31	2.915
February	29	2.719
March	29	2.747
April	28	2.860
May	31	2.856
June	30	2.947
July	31	2.907
August	31	2.995
September	30	2.947
October	31	3.037
November	30	3.047
December	31	3.044
	Sum	Avg
	362	2.918

Port Ellen (Isle of Islay) – Tide Gauge Information

Latitude 55° 37' 39.3" N **Longitude** 06° 11' 23.7" W **Grid Ref** NR 3636 4508

Instrument Data acquisition system with two full-tide bubbler gauges. Decommissioned February 2011.

Location **Tide Gauge Building** Caledonian MacBrayne storeroom next to Port Ellen ferry terminal

Measuring Points South west of the ferry terminal offices

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NR 3635 4507	Bolt SE side Booking Office
Aux1	NR 3642 4515	Rivet angle wall NW side entrance to pier
Aux2	NR 3651 4526	Police Station SE side of road SW face W angle
Aux3	NR 3635 4521	Sea Farm C gable NW face W angle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 0.19m below Ordnance Datum Newlyn (ODN)

TGZ = 2.839m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 170 Carried out survey for new gauge building and steelwork

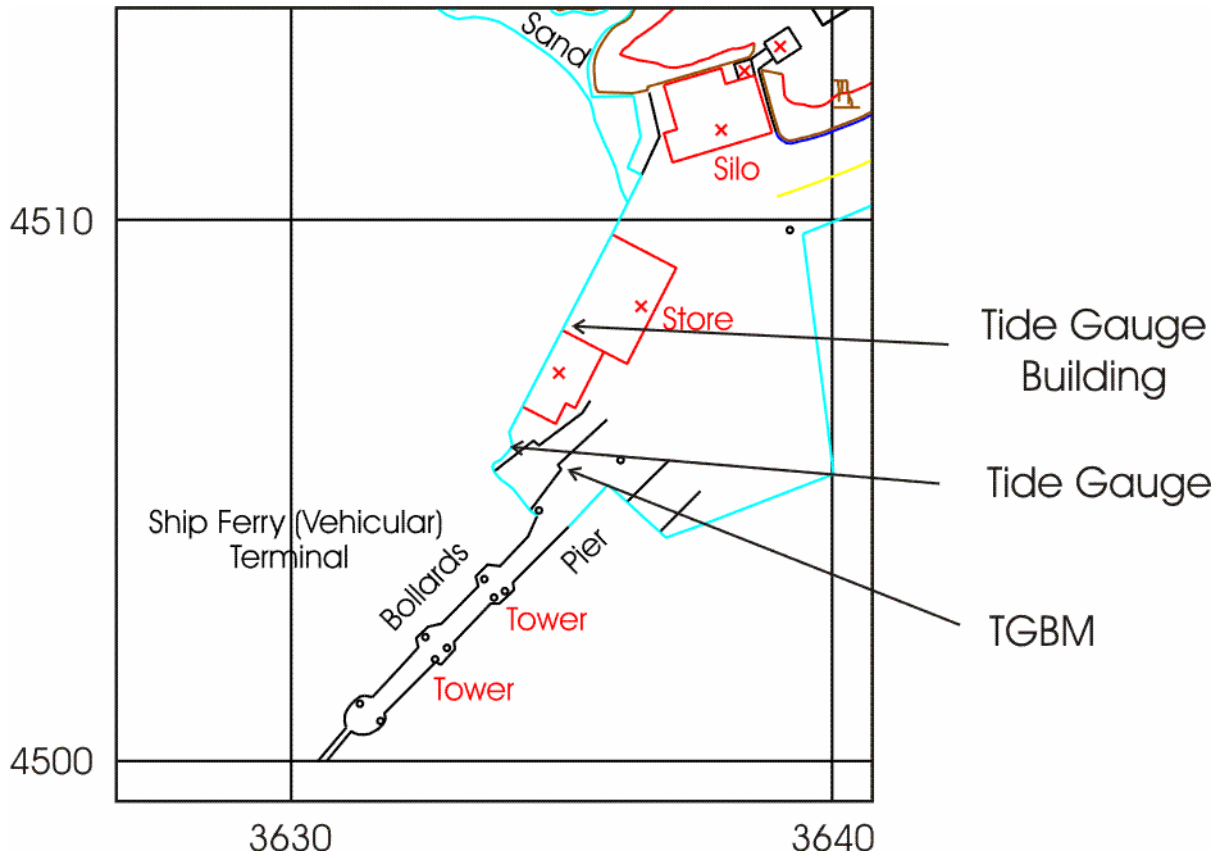
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
n/a	n/a	n/a	n/a

Notes on Completeness/Quality

Gauge was removed from network due to harbour redevelopment on 08/02/2011. Work on a replacement installation has commenced and is ongoing.

Port Ellen (Isle of Islay) – Map & Images of Site



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Port Ellen (Isle of Islay) – Statistics

The gauge wasn't operational during 2012, so no statistics were produced.

St Helier (Jersey) – Tide Gauge Information

Latitude 49° 10' 34" N **Longitude** 02° 06' 51 " W **Grid Ref** 13/11 6466 4763

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge
Location **Tide Gauge Building** Victoria Pier, adjacent to the Port Control building
Measuring Points inside wall of the pier, 2m from the tide gauge building

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	13/11 6465 4764	Pin bollard Victoria Pier
Aux1	13/11 6516 4764	Cut mark wall N side of road Mount Bingham
Aux2	13/11 6509 4780	"J" stone E face wall car park South Hill
Aux3	13/11 6507 4779	Cut mark S face wall car park South Hill
Aux4	13/11 6506 4784	Cut mark E face wall E side Commercial Rd

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 5.88m below Ordnance Datum Local (ODL)

TGZ = 13.658m below TGBM

Levelling No levelling was carried out in 2012

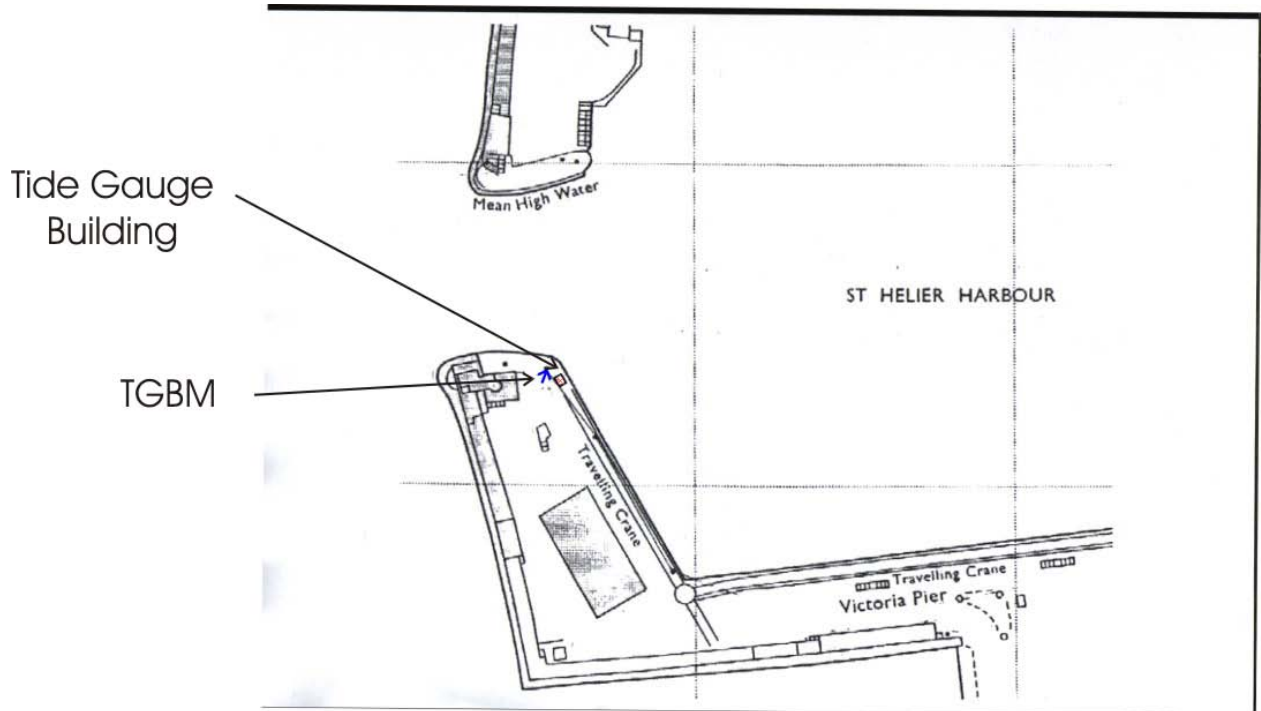
Site visits

Day 166-167 Carried out general maintenance and replaced compressor

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031,083	088,167,291

St Helier (Jersey) – Map & Images of Site



©States of Jersey 2012



St Helier (Jersey) – Statistics

Surge maxima	Value	Day	Time
January	0.498	5	08:15:00
February	0.174	18	16:30:00
March	0.164	7	09:15:00
April	0.864	25	15:15:00
May	0.345	9	23:45:00
June	0.563	7	15:15:00
July	0.352	7	17:15:00
August	0.55	15	10:30:00
September	0.628	24	07:30:00
October	0.534	31	23:00:00
November	0.711	25	00:15:00
December	0.668	27	10:45:00

Surge minima	Value	Day	Time
January	-0.488	11	04:45:00
February	-0.637	13	06:30:00
March	-0.609	11	18:00:00
April	-0.264	1	01:15:00
May	-0.4	12	08:00:00
June	-0.186	26	19:30:00
July	-0.24	17	15:15:00
August	-0.312	31	04:15:00
September	-0.317	13	13:45:00
October	-0.325	28	02:30:00
November	-0.269	15	16:45:00
December	-0.434	8	10:15:00

Extreme maxima	Value	Day	Time
January	11.22	25	07:45:00
February	11.318	10	08:00:00
March	11.645	10	07:45:00
April	11.889	9	20:30:00
May	11.785	7	19:15:00
June	11.475	5	19:15:00
July	11.392	5	19:45:00
August	11.469	3	19:30:00
September	11.692	17	19:15:00
October	11.849	17	19:30:00
November	11.6	15	07:00:00
December	11.802	15	07:30:00

Extreme minima	Value	Day	Time
January	1.218	11	14:15:00
February	0.555	10	14:45:00
March	0.223	10	14:30:00
April	0.472	8	01:45:00
May	0.771	7	01:15:00
June	1.001	5	01:00:00
July	1.12	6	02:30:00
August	1.158	21	03:00:00
September	0.837	18	02:00:00
October	0.989	16	13:15:00
November	0.782	15	13:45:00
December	1.246	15	14:15:00

Mean sea level	Days	MSL
January	31	5.997
February	29	5.803
March	28	5.857
April	30	6.122
May	31	6.028
June	30	6.096
July	31	6.075
August	31	6.117
September	30	6.083
October	31	6.203
November	30	6.199
December	31	6.188
	Sum	Avg
	363	6.064

Kinlochbervie – Tide Gauge Information

Latitude 58° 27' 23.8" N **Longitude** 05° 03' 01.3" W **Grid Ref** NC 2213 5608

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** In the ice plant, on the pier

Measuring Points On a leg of the jetty beneath the ice plant

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NC 2206 5613	Bolt S side harbour 19.5M SE angle of building
Aux1	NC 2210 5612	Rivet iceplant 7.45M from S angle of building
Aux2	NC 2210 5614	Rivet inside iceplant 3.5M E door
Aux3	NC 2203 5626	Rivet 12.3M SE N angle of building
Aux4	NC 2213 5621	Rivet 2.5M NW inside corner NE steps

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.50m below Ordnance Datum Newlyn (ODN)

TGZ = 7.213m below TGBM

Levelling No levelling was carried out in 2012

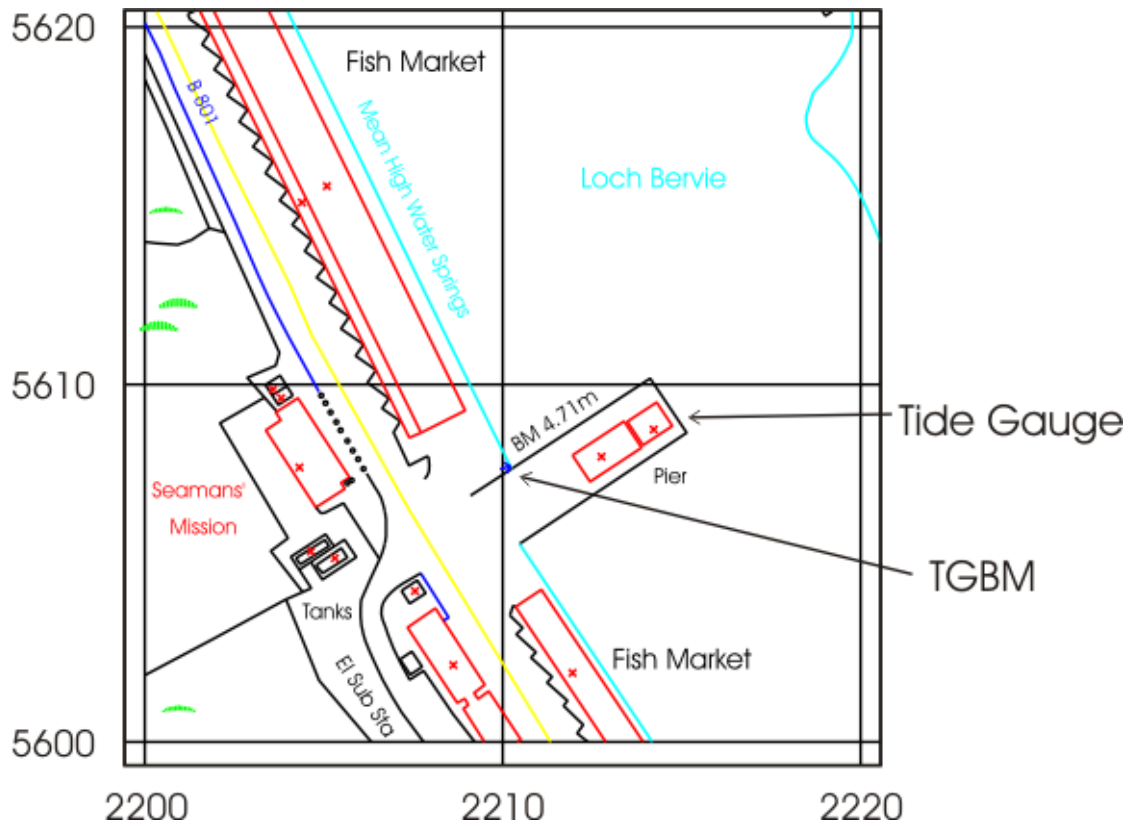
Site visits

No site visits in 2012

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	017,018,025,035,040,043

Kinlochbervie – Map & Images of Site



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Kinlochbervie – Statistics

Surge maxima	Value	Day	Time
January	0.523	5	00:30:00
February	0.287	18	08:00:00
March	0.552	7	00:30:00
April	0.403	17	12:00:00
May	0.707	13	22:00:00
June	0.345	29	10:15:00
July	0.327	22	17:00:00
August	0.506	27	16:45:00
September	0.546	13	18:45:00
October	0.448	31	10:00:00
November	0.568	19	18:30:00
December	0.891	29	08:00:00

Surge minima	Value	Day	Time
January	-0.519	5	23:45:00
February	-0.571	13	18:45:00
March	-0.329	5	13:15:00
April	-0.392	30	08:45:00
May	-0.323	1	01:45:00
June	-0.153	2	05:15:00
July	-0.236	7	12:30:00
August	-0.252	31	01:00:00
September	-0.409	25	23:00:00
October	-0.325	26	21:00:00
November	-0.494	27	19:30:00
December	-0.436	7	22:15:00

Extreme maxima	Value	Day	Time
January	5.325	25	08:30:00
February	5.155	22	07:30:00
March	5.449	9	07:15:00
April	5.417	8	20:15:00
May	5.158	7	20:00:00
June	5.158	5	19:30:00
July	5.115	4	19:45:00
August	5.193	1	18:45:00
September	5.42	17	19:45:00
October	5.35	16	07:15:00
November	5.343	15	07:45:00
December	5.653	15	08:30:00

Extreme minima	Value	Day	Time
January	0.521	13	16:00:00
February	0.133	11	15:45:00
March	-0.034	10	14:45:00
April	0.081	7	13:30:00
May	0.239	6	13:15:00
June	0.443	5	01:45:00
July	0.317	6	02:45:00
August	0.446	31	01:00:00
September	0.301	19	03:00:00
October	0.388	17	02:00:00
November	0.445	15	01:30:00
December	0.757	15	14:45:00

Mean sea level	Days	MSL
January	31	2.949
February	29	2.776
March	31	2.784
April	30	2.759
May	31	2.743
June	30	2.795
July	31	2.807
August	31	2.906
September	30	2.953
October	31	2.949
November	30	3.052
December	31	3.008
	Sum	Avg
	366	2.873

Leith – Tide Gauge Information

Latitude 55° 59' 23.4"N **Longitude** 03° 10' 54.1"W **Grid Ref** NT 2638 7806

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** Lead-in jetty, east of the entrance to Leith docks
Measuring Points As above

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NT 2643 7797	OSBM Bolt SE end of TG pier 0.9m N angle of pier
Aux1	NT 2648 7797	Rivet on top step SW side of road 1.6m S angle of building
Aux2	NT 2653 7789	Rivet top step SW side of road 11.9M W angle of building

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.90m below Ordnance Datum Newlyn (ODN)

TGZ = 7.84mm below TGBM

Levelling No levelling was carried out in 2012

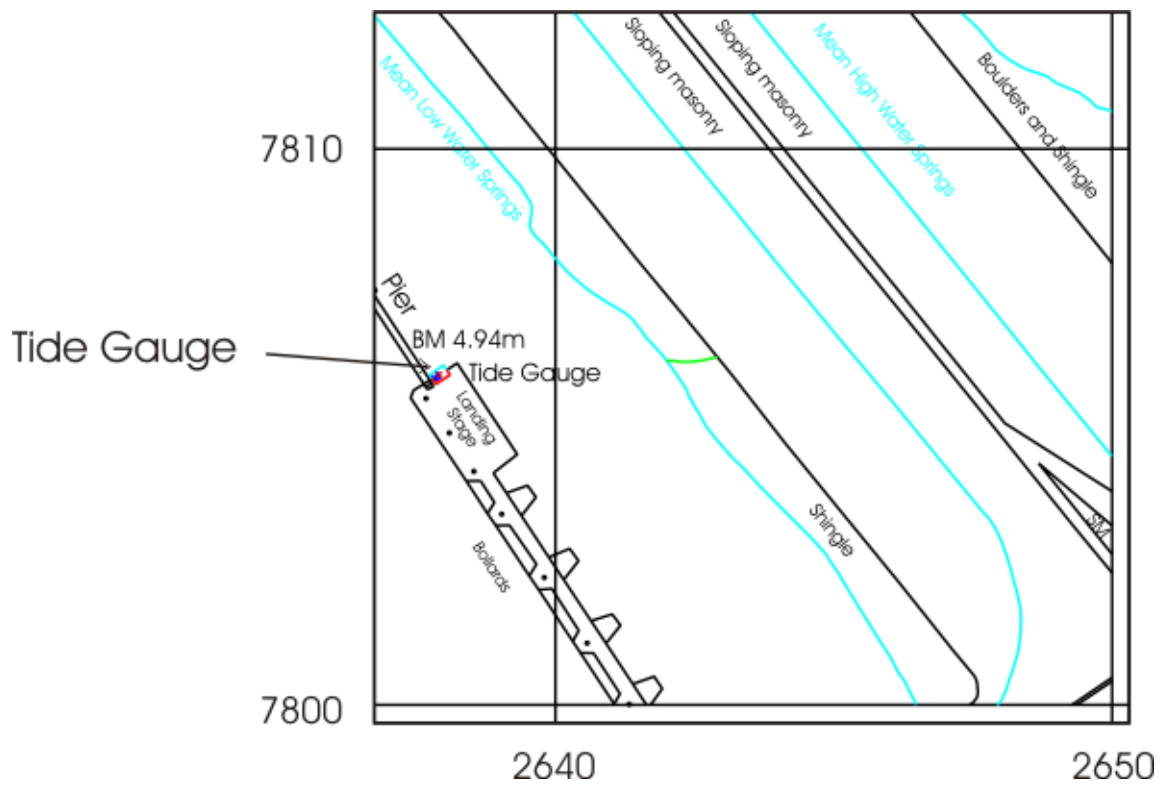
Site visits

Day 012 Replaced compressor

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	014,025,062,064

Leith – Map & Images of Site



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Leith – Statistics

Surge maxima	Value	Day	Time
January	0.816	5	17:00:00
February	0.366	24	20:00:00
March	0.484	7	10:00:00
April	0.412	3	05:30:00
May	0.535	14	05:30:00
June	0.297	8	01:15:00
July	0.297	23	15:30:00
August	0.368	28	08:00:00
September	0.627	14	10:15:00
October	0.474	31	23:30:00
November	0.532	20	11:00:00
December	0.768	29	18:45:00

Surge minima	Value	Day	Time
January	-1.07	3	10:45:00
February	-0.546	10	16:00:00
March	-0.332	19	16:15:00
April	-0.303	30	19:30:00
May	-0.302	12	16:45:00
June	-0.165	29	07:15:00
July	-0.179	29	14:15:00
August	-0.301	31	09:45:00
September	-0.301	6	12:30:00
October	-0.275	12	21:15:00
November	-0.337	27	10:30:00
December	-0.542	23	12:15:00

Extreme maxima	Value	Day	Time
January	5.765	12	16:30:00
February	5.802	24	16:15:00
March	6.022	9	15:30:00
April	6.218	9	16:15:00
May	5.963	7	15:15:00
June	5.971	6	16:00:00
July	5.794	5	03:15:00
August	5.874	4	03:30:00
September	6.007	18	03:30:00
October	6.238	17	03:00:00
November	6.095	15	02:45:00
December	6.11	15	15:45:00

Extreme minima	Value	Day	Time
January	0.291	25	22:00:00
February	-0.001	10	22:30:00
March	0.044	8	21:00:00
April	0.124	7	21:15:00
May	0.325	6	20:45:00
June	0.424	5	08:45:00
July	0.415	6	10:15:00
August	0.425	31	08:30:00
September	0.367	18	09:30:00
October	0.444	15	08:00:00
November	0.532	15	21:30:00
December	0.408	15	22:00:00

Mean sea level	Days	MSL
January	31	3.186
February	29	3.045
March	31	3.079
April	30	3.172
May	31	3.122
June	30	3.202
July	31	3.184
August	31	3.234
September	30	3.262
October	31	3.284
November	30	3.327
December	31	3.242
	Sum	Avg
	366	3.195

Lerwick – Tide Gauge Information

Latitude 60° 09' 14.5" N **Longitude** 01° 08' 25.1" W **Grid Ref** HU 4783 4137

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge
Location **Tide Gauge Building** Inner wall at breakwater entrance to the small boat harbour, south of Victoria Pier
Measuring Points As above

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	HU 4783 4129	OSBM bolt on breakwater wall
Aux1	HU 4784 4125	Queen’s Hotel 7.5m SW face south angle
Aux2	HU 4777 4110	Lerwick Parish Church North face NW angle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 1.22m below Ordnance Datum Local (ODL)
 TGZ = 4.57m below TGBM

Levelling No levelling was carried out in 2012

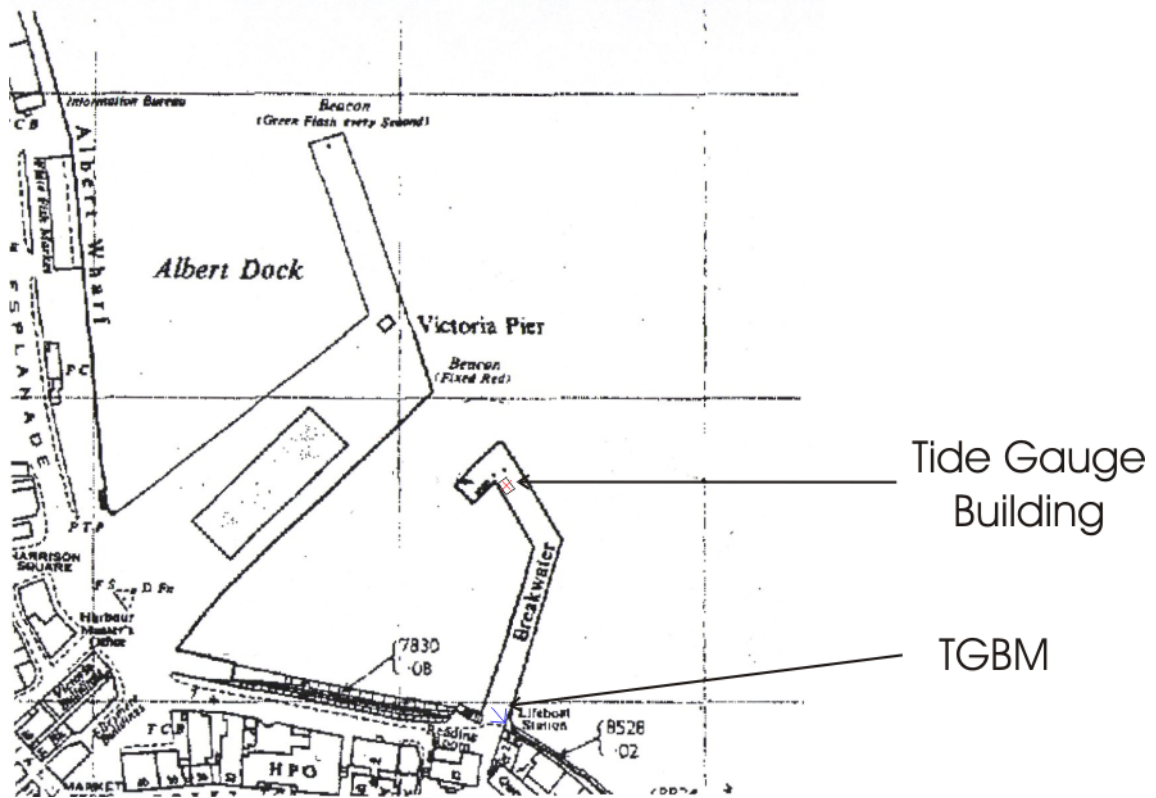
Site visits

Day 116-118 Oversaw electrical upgrade and installed Swantel telemetry system
 Day 312-313 Replaced compressor and installed a signal conditioning circuit in the Dataring logger

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	171	117-121

Lerwick – Map & Images of Site



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Lerwick – Statistics

Surge maxima	Value	Day	Time
January	0.425	3	11:30:00
February	0.272	24	03:15:00
March	0.311	7	12:30:00
April	0.342	10	17:00:00
May	0.471	14	00:00:00
June	0.233	29	16:45:00
July	0.247	23	16:30:00
August	0.279	28	11:15:00
September	0.394	14	07:15:00
October	0.342	31	04:45:00
November	0.377	2	05:15:00
December	0.527	29	16:30:00

Surge minima	Value	Day	Time
January	-0.335	29	00:15:00
February	-0.377	7	08:45:00
March	-0.218	2	08:30:00
April	-0.16	4	08:30:00
May	-0.306	1	02:15:00
June	-0.077	27	00:15:00
July	-0.161	6	16:00:00
August	-0.162	31	10:45:00
September	-0.19	26	04:45:00
October	-0.229	23	04:00:00
November	-0.281	28	00:45:00
December	-0.369	10	23:00:00

Extreme maxima	Value	Day	Time
January	2.381	21	09:30:00
February	2.436	22	11:15:00
March	2.387	9	11:30:00
April	2.518	9	12:30:00
May	2.206	6	11:00:00
June	2.29	7	00:30:00
July	2.318	23	01:00:00
August	2.323	21	01:00:00
September	2.548	16	23:00:00
October	2.502	31	11:15:00
November	2.506	16	12:00:00
December	2.709	15	12:00:00

Extreme minima	Value	Day	Time
January	0.213	13	19:45:00
February	-0.001	9	18:00:00
March	0.114	10	18:15:00
April	0.111	7	17:15:00
May	0.202	4	15:15:00
June	0.236	5	05:00:00
July	0.101	6	06:30:00
August	0.252	31	04:30:00
September	0.286	1	05:15:00
October	0.292	15	04:00:00
November	0.437	13	03:45:00
December	0.338	11	02:30:00

Mean sea level	Days	MSL
January	31	1.342
February	29	1.211
March	31	1.217
April	24	1.253
May	30	1.194
June	30	1.258
July	31	1.281
August	31	1.320
September	30	1.404
October	31	1.397
November	30	1.477
December	31	1.378
	Sum	Avg
	359	1.311

Liverpool – Tide Gauge Information

Latitude 53° 26' 58.9" N **Longitude** 03° 01' 04.8" W **Grid Ref** SJ 3249 9525

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** In the old Lock Keeper’s office at the entrance to Gladstone Dock

Measuring Points Seaward side of Gladstone Dock

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SJ 3249 9525	NBM rivet NE face E angle base of building
Aux1	SJ 3250 9523	Rivet E side of quay above hinge SW dock gate
Aux2	SJ 3244 9538	Building wall E face SE angle
Aux3	SJ 3294 9558	Rivet concrete adjacent to building No 335

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 4.93m below Ordnance Datum Newlyn (ODN)

TGZ = 14.475m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 005 Migrated to Swantel telemetry system and decommissioned DATARING logger

Day 100 Replaced compressor

Day 335 Meeting regarding security issues and the proposed redevelopment of the site

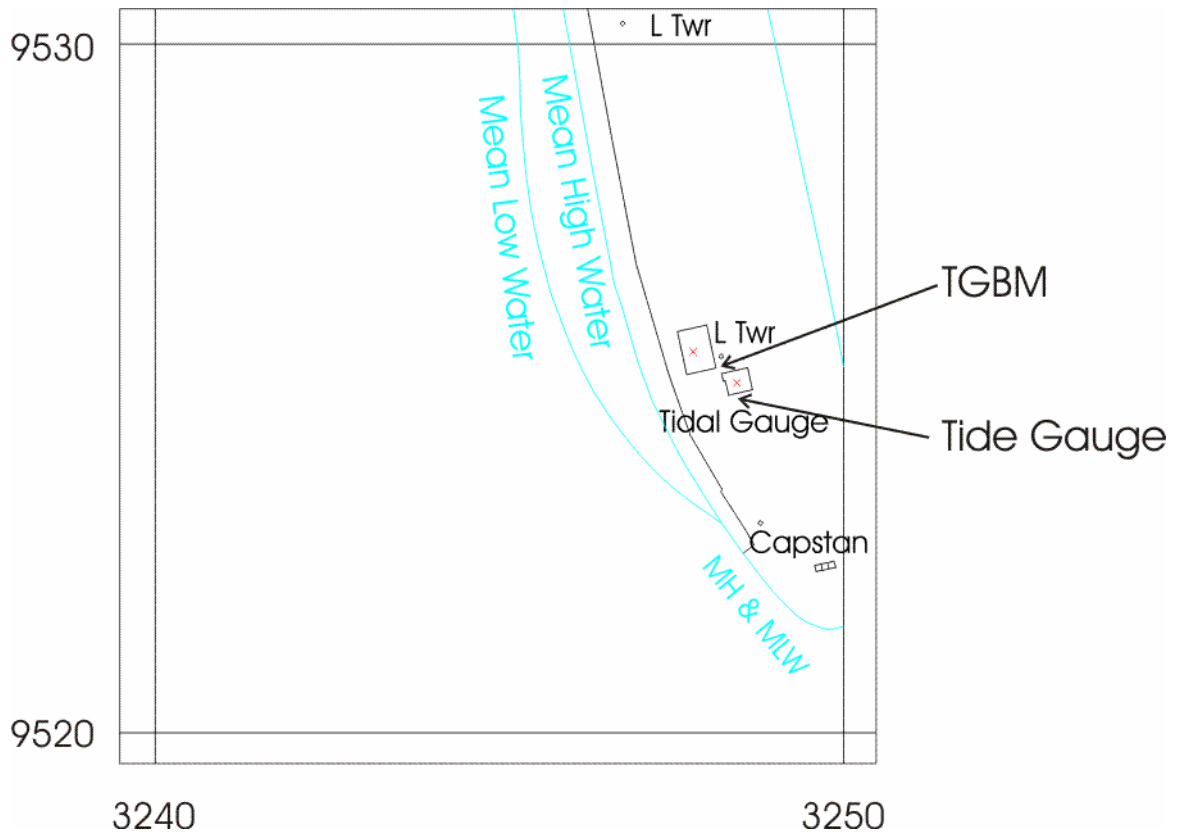
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	005,031	001-005,005-016,019-022,025-027,039-059,067-073,081-101,130,347-353

Notes on Completeness/Quality

The primary channel was ~50mm high at times during December, which was acceptable for monitoring extremes but was flagged as unacceptable for the purposes of long-term sea level monitoring. The data on both channels were occasionally noisy. Access to the tide gauge equipment was temporarily prevented by engineering works to the dock gates.

Liverpool – Map & Images of Site



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Liverpool – Statistics

Surge maxima	Value	Day	Time
January	0.637	22	12:00:00
February	0.168	4	19:45:00
March	0.378	3	14:00:00
April	0.809	17	05:30:00
May	0.724	14	00:00:00
June	0.721	8	21:15:00
July	0.465	18	05:45:00
August	0.811	15	18:00:00
September	0.587	12	14:00:00
October	1.072	16	07:30:00
November	0.78	19	10:15:00
December	0.912	31	07:45:00

Surge minima	Value	Day	Time
January	-0.429	12	21:15:00
February	-0.408	5	06:30:00
March	-0.276	5	17:00:00
April	-0.786	29	16:30:00
May	-0.128	13	01:00:00
June	-0.173	3	17:00:00
July	-0.143	26	02:45:00
August	-0.192	30	12:30:00
September	-0.184	21	10:15:00
October	-0.308	26	23:45:00
November	-0.437	27	12:15:00
December	-0.515	27	18:45:00

Extreme maxima	Value	Day	Time
January	9.956	24	11:45:00
February	8.814	7	10:45:00
March	8.926	6	22:00:00
April	9.695	11	01:45:00
May	10.167	8	00:00:00
June	9.965	7	00:30:00
July	9.908	4	23:30:00
August	9.98	4	00:00:00
September	10.227	17	23:45:00
October	10.464	17	11:45:00
November	9.978	15	11:30:00
December	10.358	14	23:45:00

Extreme minima	Value	Day	Time
January	0.936	12	20:00:00
February	1.077	7	17:45:00
March	1.587	20	16:45:00
April	1.439	11	08:45:00
May	0.727	6	18:00:00
June	0.895	5	06:00:00
July	0.93	5	06:45:00
August	1.038	3	06:15:00
September	0.909	19	07:45:00
October	0.849	17	06:30:00
November	0.726	15	06:15:00
December	1.057	14	05:45:00

Mean sea level	Days	MSL
January	7	*
February	6	*
March	10	*
April	19	5.308
May	31	5.296
June	30	5.386
July	31	5.343
August	31	5.413
September	30	5.410
October	31	5.471
November	30	5.483
December	24	5.488
	Sum	Avg
	280	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Llandudno – Tide Gauge Information

Latitude 53° 19' 54.0" N **Longitude** 03° 49' 30.8" W **Grid Ref** SH 7855 8319

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** A sub-platform under the pavilion at the end of Llandudno pier

Measuring Points A leg of the pier below the tide gauge building

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SH 7834 8292	Rivet stone butt gate entrance
Aux1	SH 7827 8255	OSBM bolt concrete step SE side of slipway
Aux2	SH 7840 8243	OSBM bolt bottom concrete step
Aux3	SH 7864 8229	OSBM bolt concrete ramp 6.5M NW C slipway

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 3.85m below Ordnance Datum Newlyn (ODN)

TGZ = 12.558m below TGBM

Levelling No levelling was carried out in 2012

Site visits

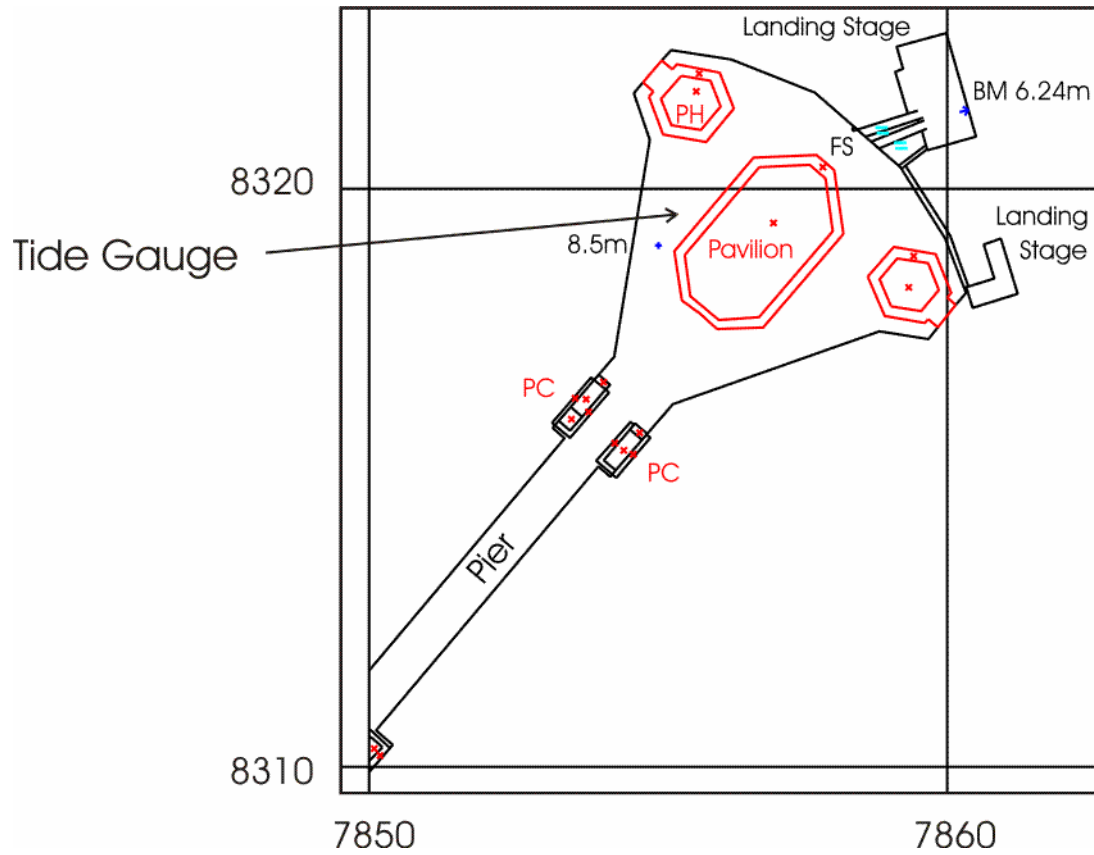
Day 038 Carried out general maintenance

Day 179 Carried out general maintenance

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	021,028,038,172,179,346-347

Llandudno – Map & Images of Site



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Llandudno – Statistics

Surge maxima	Value	Day	Time
January	1.297	3	11:30:00
February	0.45	18	09:00:00
March	0.346	7	06:00:00
April	0.61	17	05:00:00
May	0.425	13	23:45:00
June	0.53	15	16:00:00
July	0.242	16	14:30:00
August	0.689	15	17:15:00
September	0.317	28	05:30:00
October	0.662	17	15:00:00
November	0.671	22	12:00:00
December	0.747	29	04:15:00

Surge minima	Value	Day	Time
January	-0.517	5	17:15:00
February	-0.581	13	23:30:00
March	-0.368	11	21:30:00
April	-0.961	29	16:00:00
May	-0.309	12	00:30:00
June	-0.193	3	16:30:00
July	-0.151	26	02:45:00
August	-0.306	30	13:00:00
September	-0.234	5	11:45:00
October	-0.436	26	23:30:00
November	-0.646	26	21:30:00
December	-0.629	7	15:45:00

Extreme maxima	Value	Day	Time
January	8.092	25	12:00:00
February	7.916	22	11:00:00
March	8.069	9	11:15:00
April	8.346	9	12:15:00
May	8.289	7	23:30:00
June	8.142	5	23:15:00
July	8.076	4	23:15:00
August	8.146	3	23:30:00
September	8.293	17	23:30:00
October	8.607	17	11:30:00
November	8.134	16	12:00:00
December	8.433	15	11:45:00

Extreme minima	Value	Day	Time
January	0.164	12	19:15:00
February	-0.095	10	19:00:00
March	-0.325	10	18:30:00
April	-0.219	7	17:30:00
May	0.087	6	17:00:00
June	0.255	5	05:15:00
July	0.282	6	06:45:00
August	0.343	31	04:30:00
September	0.127	19	06:45:00
October	0.256	16	17:15:00
November	0.105	15	05:30:00
December	0.386	15	18:30:00

Mean sea level	Days	MSL
January	31	4.067
February	29	3.876
March	31	3.913
April	30	4.020
May	31	4.030
June	28	4.122
July	31	4.078
August	31	4.157
September	30	4.103
October	31	4.192
November	30	4.196
December	28	4.203
	Sum	Avg
	361	4.080

Lowestoft – Tide Gauge Information

Latitude 52° 28' 23.2" N **Longitude** 01° 45' 00.4" E **Grid Ref** TM 5478 9274

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** East of the Harbour Master's office

Measuring Points On the quay wall, east of the tide gauge building

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark Grid Ref Description

TGBM TM 5482 9273 Bolt on quay wall S side of pier

Aux1 TM 5477 9272 Bolt on concrete jetty at SW corner of TG building

Aux2 TM 5478 9274 CM Harbour Masters Office SE angle S face

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 1.50m below Ordnance Datum Newlyn (ODN)

TGZ = 4.483m below TGBM

Levelling No levelling was carried out in 2012

Site visits

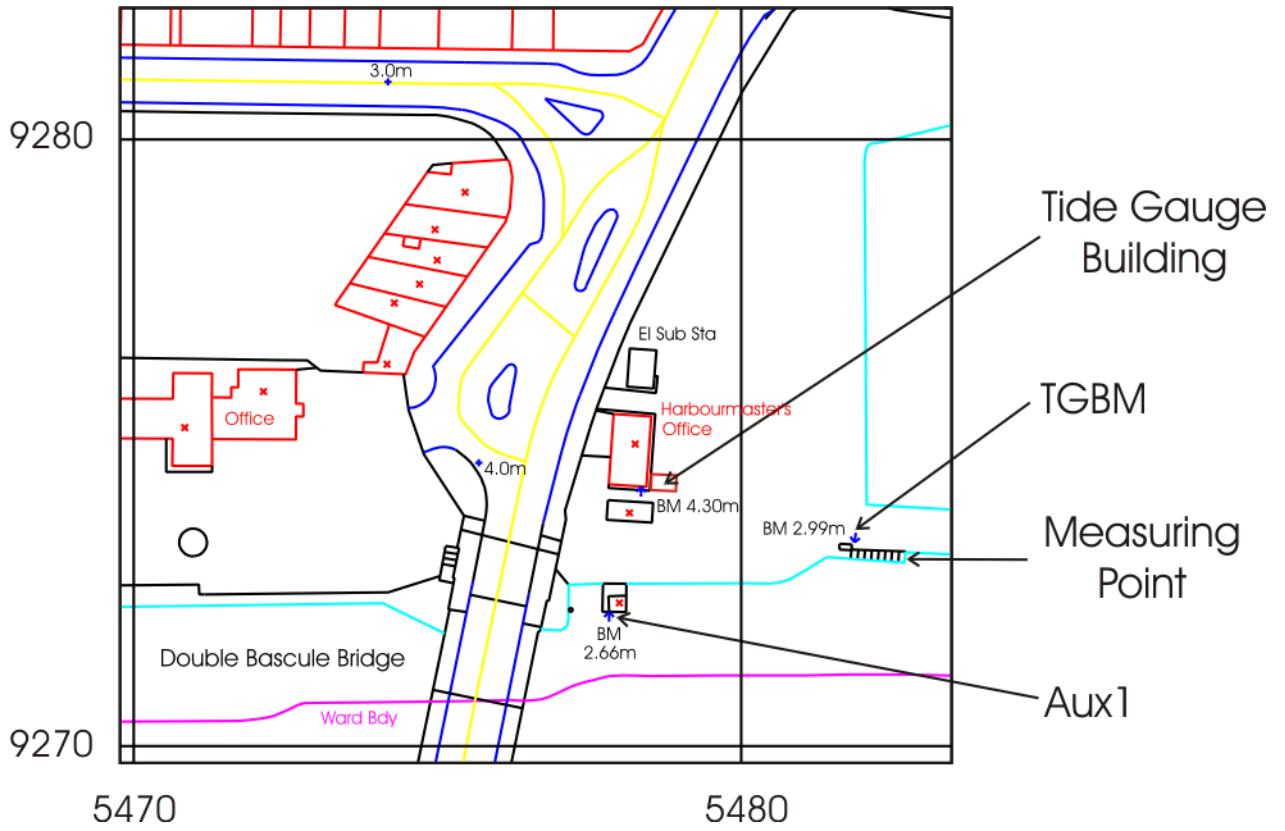
Day 019 Migrated to Swantel telemetry system and decommissioned DATARING logger

Day 186 Upgraded telemetry outstation hardware and replaced compressor

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	019,038,043,051,186

Lowestoft – Map & Images of Site



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Lowestoft – Statistics

Surge maxima	Value	Day	Time
January	1.448	5	17:00:00
February	0.746	19	03:15:00
March	0.58	7	20:30:00
April	0.309	7	05:30:00
May	0.473	14	12:00:00
June	0.264	11	20:30:00
July	0.298	19	15:00:00
August	0.546	30	16:30:00
September	0.738	14	15:45:00
October	0.625	27	05:15:00
November	0.463	4	14:15:00
December	0.921	9	21:00:00

Surge minima	Value	Day	Time
January	-0.652	26	06:45:00
February	-0.807	4	23:30:00
March	-0.704	7	08:45:00
April	-0.587	17	10:30:00
May	-0.376	13	02:30:00
June	-0.357	8	16:15:00
July	-0.264	22	16:00:00
August	-0.424	27	21:45:00
September	-0.462	30	13:45:00
October	-0.332	16	06:15:00
November	-0.708	22	23:30:00
December	-0.765	28	20:00:00

Extreme maxima	Value	Day	Time
January	3.637	5	18:15:00
February	2.959	14	01:00:00
March	3.09	7	20:45:00
April	2.832	11	00:30:00
May	2.658	15	17:30:00
June	2.703	4	08:45:00
July	2.794	19	09:30:00
August	2.901	30	20:45:00
September	2.996	14	20:15:00
October	2.957	27	06:15:00
November	2.857	15	10:00:00
December	3.176	29	22:15:00

Extreme minima	Value	Day	Time
January	-0.136	26	05:30:00
February	-0.061	11	05:45:00
March	0.011	9	04:00:00
April	0.212	8	04:30:00
May	0.274	8	04:45:00
June	0.147	8	18:15:00
July	0.264	22	17:45:00
August	0.354	3	16:30:00
September	0.184	30	15:45:00
October	0.331	16	15:45:00
November	0.416	19	07:30:00
December	0.008	15	04:30:00

Mean sea level	Days	MSL
January	28	1.690
February	29	1.521
March	31	1.558
April	30	1.645
May	31	1.622
June	30	1.626
July	28	1.675
August	31	1.703
September	30	1.754
October	31	1.773
November	30	1.784
December	31	1.680
	Sum	Avg
	360	1.669

Milford Haven – Tide Gauge Information

Latitude 51° 42' 26.6" N **Longitude** 05° 03' 05.5" W **Grid Ref** SM 8925 0537

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge
Location **Tide Gauge Building** Store room at the shore end of Milford Haven Port Authority jetty
Measuring Points Seaward end of the jetty

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SM 8921 0536	OSBM Bolt on wall W side of entrance to jetty
Aux1	SM 8918 0541	Fl Br G4977 office buildings. SW face NW angle.
Aux2	SM 9001 0601	OSBM bolt wall Victoria Road

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 3.71m below Ordnance Datum Newlyn (ODN)
 TGZ = 16.734m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 026 Replaced compressor following repeated electrical problems
 Day 031 Replaced compressor following further electrical problems

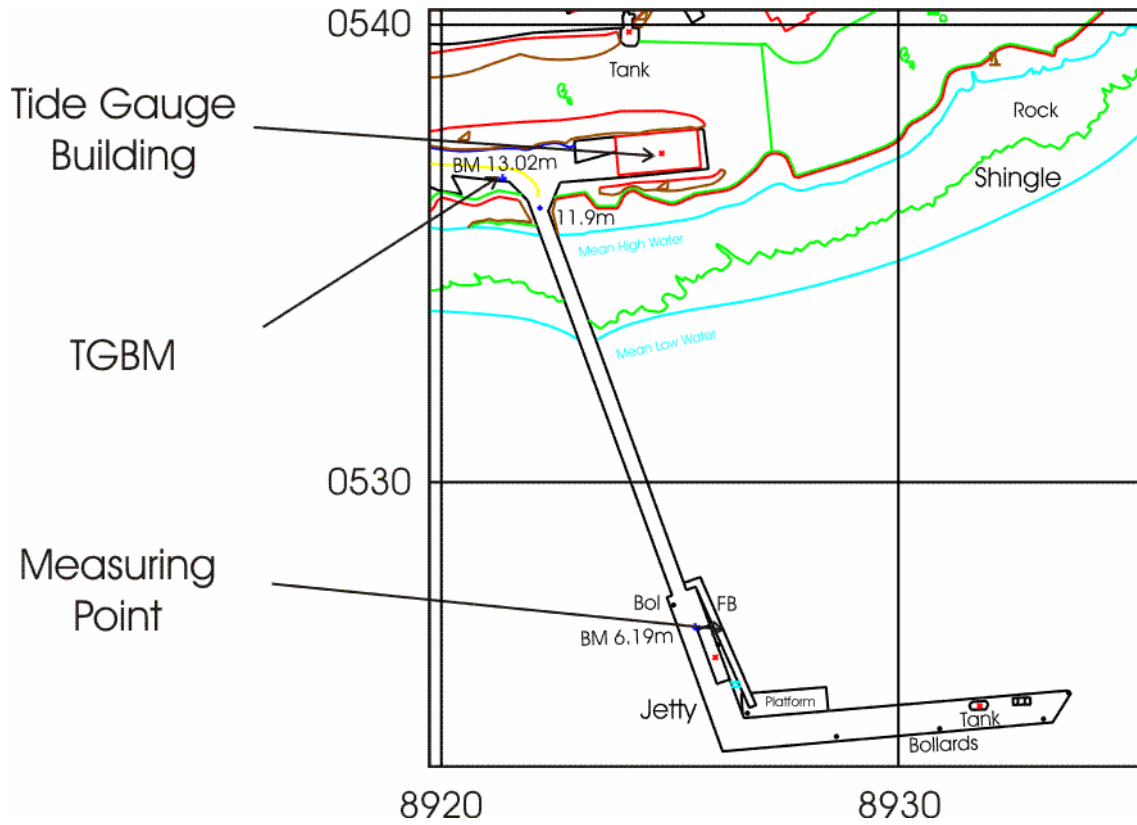
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	001-176,187-366

Notes on Completeness/Quality

The primary channel was occasionally 40-50mm, which was acceptable for monitoring extremes but was flagged as unacceptable for the purposes of long-term sea level monitoring. The secondary channel was available throughout.

Milford Haven – Map & Images of Site



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Milford Haven – Statistics

Surge maxima	Value	Day	Time
January			
February			
March			
April			
May			
June	0.334	28	23:45:00
July	0.252	4	03:30:00
August			
September			
October			
November			
December			

Surge minima	Value	Day	Time
January			
February			
March			
April			
May			
June	-0.044	24	21:45:00
July	0.072	1	10:45:00
August			
September			
October			
November			
December			

Extreme maxima	Value	Day	Time
January			
February			
March			
April			
May			
June	6.476	24	21:15:00
July	7.448	5	19:30:00
August			
September			
October			
November			
December			

Extreme minima	Value	Day	Time
January			
February			
March			
April			
May			
June	1.497	25	03:30:00
July	0.766	5	01:00:00
August			
September			
October			
November			
December			

Mean sea level	Days	MSL
January	0	*
February	0	*
March	0	*
April	0	*
May	0	*
June	6	*
July	4	*
August	0	*
September	0	*
October	0	*
November	0	*
December	0	*
	Sum	Avg
	10	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Millport – Tide Gauge Information

Latitude 55° 44' 59.3" N **Longitude** 04° 54' 22.8" W **Grid Ref** NS 1769 5454

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** Store room at the shore end of the University Marine Biological Station pier

Measuring Points Seaward end of the pier

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NS 1757 5449	Fl Br G4602 Marine station
Aux1	NS 1772 5457	OSBM bolt rock SE side Rd 5M NE end wall
Aux2	NS 1769 5454	Rivet pier 0.8M prod SE face of TG building
Aux3	NS 1718 5451	No 45 Marine Parade NW angle N face

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 1.62m below Ordnance Datum Newlyn (ODN)

TGZ = 7.825m below TGBM

Levelling No levelling was carried out in 2012

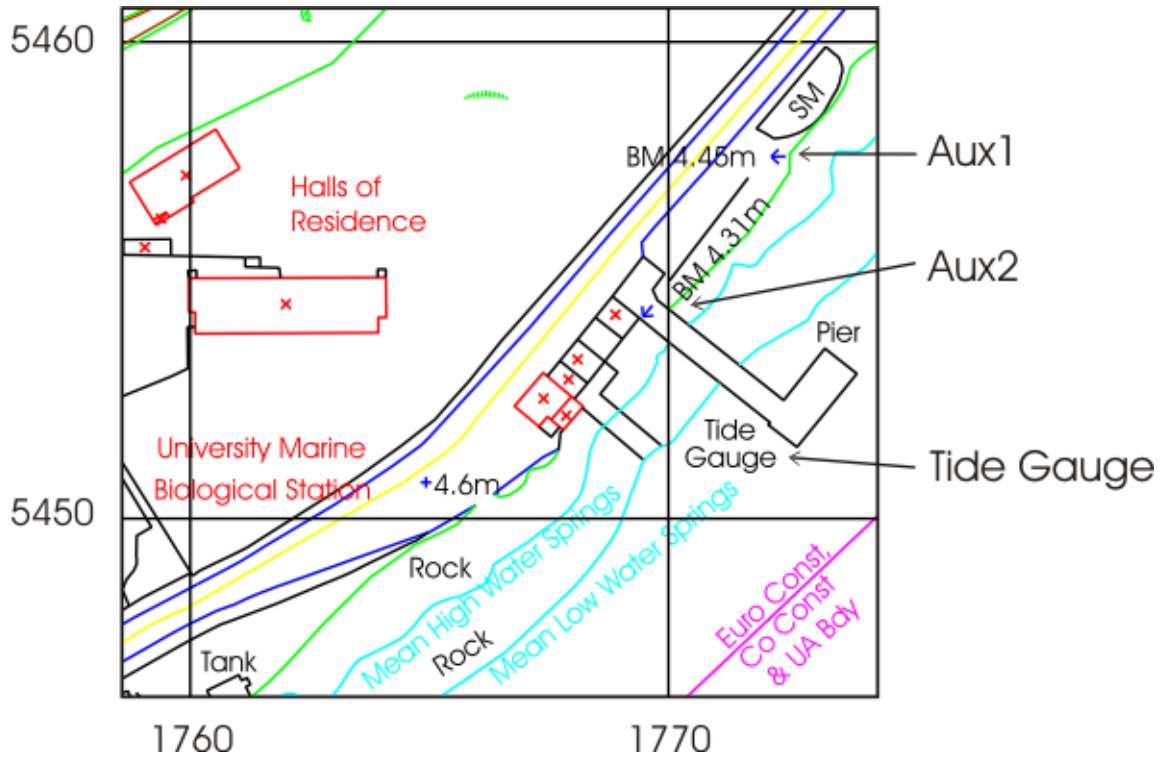
Site visits

Day 314 Replaced compressor and investigated communications fault (BT line was dead)

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	011,046,314

Millport – Map & Images of Site



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Millport – Statistics

Surge maxima	Value	Day	Time
January	1.71	3	08:45:00
February	0.415	22	09:45:00
March	0.472	3	15:45:00
April	0.708	17	03:45:00
May	0.572	13	19:15:00
June	0.457	29	14:00:00
July	0.298	22	19:45:00
August	0.638	15	19:45:00
September	0.451	14	04:30:00
October	0.58	17	23:00:00
November	0.836	19	09:30:00
December	0.887	31	10:15:00

Surge minima	Value	Day	Time
January	-0.695	5	19:15:00
February	-0.657	14	03:15:00
March	-0.395	5	13:30:00
April	-0.708	29	16:30:00
May	-0.259	15	15:00:00
June	-0.16	4	03:45:00
July	-0.195	25	15:15:00
August	-0.318	30	14:00:00
September	-0.306	12	21:00:00
October	-0.436	27	01:00:00
November	-0.602	27	09:00:00
December	-0.653	7	18:30:00

Extreme maxima	Value	Day	Time
January	4.322	3	08:15:00
February	3.784	22	12:45:00
March	3.617	9	12:45:00
April	3.827	9	14:00:00
May	3.663	8	01:30:00
June	3.676	7	02:00:00
July	3.643	23	02:30:00
August	3.73	22	02:45:00
September	3.768	18	01:15:00
October	3.966	18	01:00:00
November	4.108	19	15:45:00
December	3.953	29	00:45:00

Extreme minima	Value	Day	Time
January	0.05	12	19:45:00
February	0.007	10	19:15:00
March	-0.073	10	19:00:00
April	-0.017	4	15:45:00
May	0.206	4	16:00:00
June	0.15	4	05:00:00
July	0.095	6	07:15:00
August	0.11	31	05:30:00
September	0.204	1	06:00:00
October	0.252	27	03:45:00
November	0.239	15	18:30:00
December	0.357	17	21:00:00

Mean sea level	Days	MSL
January	31	2.030
February	26	1.853
March	31	1.842
April	30	1.893
May	31	1.900
June	30	1.997
July	31	1.971
August	31	2.075
September	30	2.036
October	31	2.102
November	30	2.153
December	31	2.141
	Sum	Avg
	363	1.999

Mumbles – Tide Gauge Information

Latitude 51° 34' 12.0" N **Longitude** 03° 58' 31.6" W **Grid Ref** SS 6319 8753

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** Mumbles lifeboat station

Measuring Points Near the end of the lifeboat slipway

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SS 6298 8743	OSBM bolt living rock S side of road
Aux1	SS 6317 8752	OSBM bolt lifeboat station Mumbles Pier
Aux2	SS 6284 8750	OSBM bolt concrete base bollard Lifeboat Cottages
Aux3	SS 6258 8760	Rivet SE side concrete chamber

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 5.00m below Ordnance Datum Newlyn (ODN)

TGZ = 13.821m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 018 Investigated compressor fault

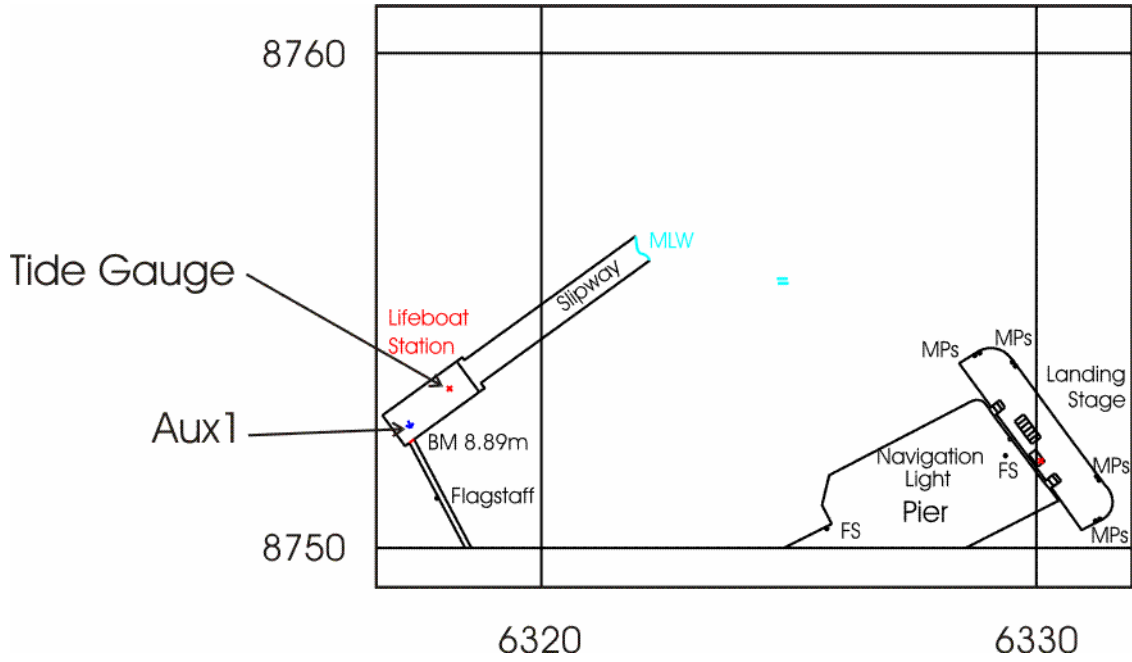
Day 025 Migrated to Swantel telemetry system, decommissioned DATARING logger and made repair to pneumatics

Day 275 Repaired damaged pneumatic tube and fitted temporary cover on slipway

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	018,025,031	001-018,018-025,029,031-066,081,267-292,320-321,341-342

Mumbles – Map & Images of Site



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Mumbles – Statistics

Surge maxima	Value	Day	Time
January	0.205	25	16:15:00
February			
March	0.237	7	09:00:00
April	0.613	25	16:00:00
May	0.399	10	00:00:00
June	0.623	7	23:30:00
July	0.319	13	20:15:00
August	0.66	15	12:00:00
September	0.258	17	22:30:00
October	0.514	31	11:45:00
November	0.768	22	15:15:00
December	0.628	14	15:30:00

Surge minima	Value	Day	Time
January	-0.311	29	05:15:00
February			
March	-0.495	12	17:45:00
April	-0.7	4	14:15:00
May	-0.328	12	07:15:00
June	-0.154	17	06:30:00
July	-0.21	26	07:30:00
August	-0.236	30	15:00:00
September	-0.3	13	01:00:00
October	-0.357	27	03:15:00
November	-0.419	27	14:30:00
December	-0.568	7	22:00:00

Extreme maxima	Value	Day	Time
January	9.645	26	08:15:00
February			
March	9.961	10	07:30:00
April	10.249	9	20:15:00
May	10.166	7	19:15:00
June	10.003	7	20:30:00
July	9.884	6	20:15:00
August	9.997	3	19:15:00
September	10.135	17	19:00:00
October	9.978	18	20:15:00
November	10.01	15	06:45:00
December	10.222	15	07:15:00

Extreme minima	Value	Day	Time
January	1.2	26	01:45:00
February			
March	0.122	11	01:45:00
April	0.327	8	13:15:00
May	0.617	7	00:30:00
June	0.822	5	00:15:00
July	0.928	6	01:30:00
August	0.877	20	13:45:00
September	0.559	18	13:30:00
October	1.228	19	02:15:00
November	0.654	15	00:30:00
December	1.06	13	12:00:00

Mean sea level	Days	MSL
January	4	*
February	0	*
March	24	5.010
April	30	5.216
May	31	5.171
June	30	5.266
July	31	5.216
August	31	5.292
September	21	5.199
October	12	*
November	26	5.351
December	27	5.369
	Sum	Avg
	267	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Newhaven – Tide Gauge Information

Latitude 50° 46' 54.4" N **Longitude** 00° 03' 25.3" E **Grid Ref** TQ 4511 0004

Instrument Data acquisition system with two full-tide bubbler gauges
Location **Tide Gauge Building** Within the Port Control building on West Pier
Measuring Points On the pier wall, south east of the Port Control building

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	TQ 4510 0003	Bolt concrete 7.4M SW of SW angle of tower
Aux1	TQ 4495 0001	OSBM bolt concrete sea wall 154.3M SW of tower
Aux2	TQ 4503 0008	Steel ball Gun mount

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 3.52m below Ordnance Datum Newlyn (ODN)
 TGZ = 8.783m below TGBM

Levelling No levelling was carried out in 2012

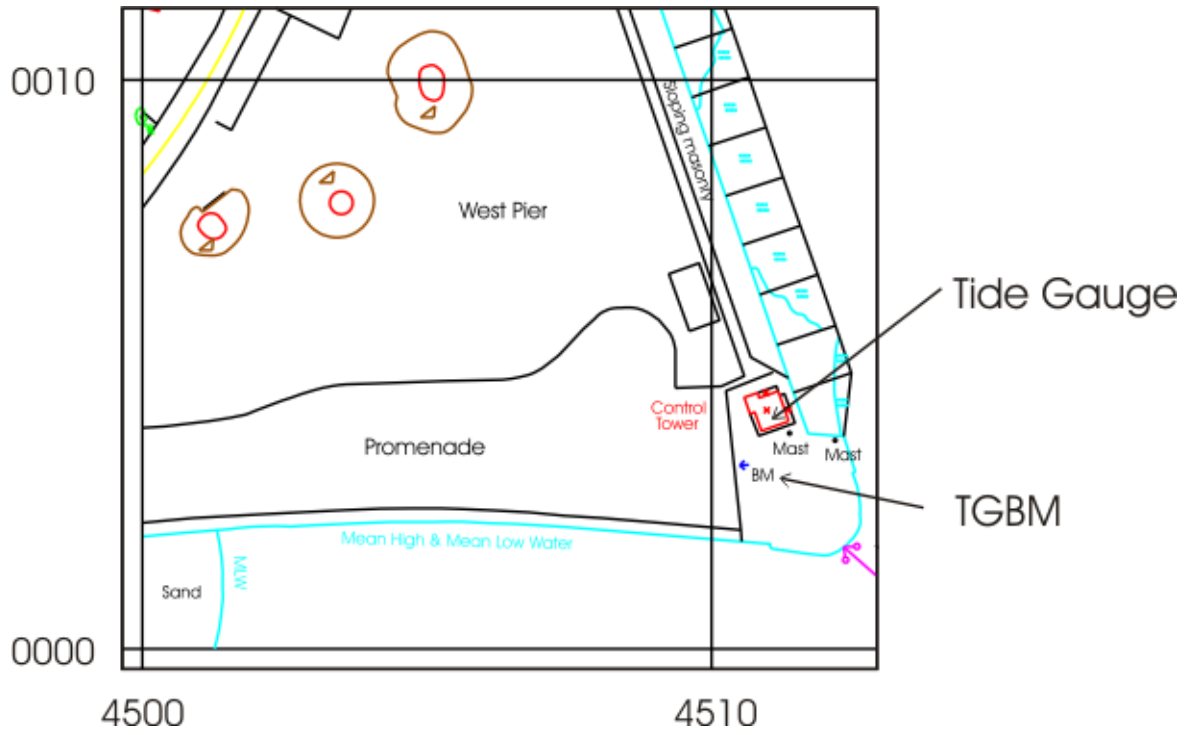
Site visits

Day 040 Migrated to Swantel telemetry system, decommissioned DATARING logger, carried out maintenance and replaced compressor
 Day 054 Investigated pneumatic problem - caused by incorrect electrical installation
 Day 312 Investigated fault - serviced and calibrated gauge equipment

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
98%	15 minutes	032,039-045	046,048-054,059,061,124

Newhaven – Map & Images of Site



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Newhaven – Statistics

Surge maxima	Value	Day	Time
January	0.215	3	07:00:00
February	0.02	1	06:45:00
March	0.096	31	17:30:00
April	0.65	25	12:45:00
May	0.259	10	00:15:00
June	0.526	7	13:00:00
July	0.281	7	15:30:00
August	0.516	15	09:15:00
September	0.314	23	21:45:00
October	0.479	17	07:15:00
November	0.377	1	01:30:00
December	0.452	14	06:45:00

Surge minima	Value	Day	Time
January	-0.374	5	12:15:00
February	-0.42	13	17:00:00
March	-0.336	11	14:45:00
April	-0.148	15	23:00:00
May	-0.294	12	19:00:00
June	-0.162	22	18:00:00
July	-0.134	22	21:30:00
August	-0.151	31	07:00:00
September	-0.161	6	19:30:00
October	-0.188	28	06:15:00
November	-0.2	6	19:30:00
December	-0.37	7	09:15:00

Extreme maxima	Value	Day	Time
January	5.659	25	06:00:00
February	5.56	10	06:00:00
March	5.663	10	05:45:00
April	6.004	9	18:30:00
May	5.983	7	17:30:00
June	5.914	7	18:45:00
July	5.857	5	17:45:00
August	5.776	19	17:45:00
September	5.907	17	17:30:00
October	6.318	17	05:15:00
November	5.922	16	06:00:00
December	6.264	14	04:45:00

Extreme minima	Value	Day	Time
January	0.608	12	13:15:00
February	0.375	9	12:15:00
March	0.115	10	12:30:00
April	0.305	8	12:15:00
May	0.599	6	11:00:00
June	0.653	4	23:00:00
July	0.745	6	00:30:00
August	0.639	31	23:15:00
September	0.551	18	00:15:00
October	0.702	15	23:15:00
November	0.559	15	11:45:00
December	0.849	15	12:15:00

Mean sea level	Days	MSL
January	31	3.113
February	29	2.964
March	31	3.022
April	28	3.250
May	31	3.187
June	30	3.240
July	30	3.202
August	22	3.305
September	30	3.237
October	31	3.375
November	30	3.348
December	31	3.309
	Sum	Avg
	354	3.213

Newlyn – Tide Gauge Information

Latitude 50° 06' 10.8" N **Longitude** 05° 32' 34.2" W **Grid Ref** SW 4676 2856

Instrument Data acquisition system with a full-tide and mid-tide bubbler gauge and a back-up potentiometer attached to a Munro float gauge

Location **Tide Gauge Building** Tidal Observatory at the end of South Pier, next to the lighthouse

Measuring Points Seaward side of the pier, behind the lighthouse

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SW 4677 2856	Brass bolt in the floor of the recorder hut.
Aux1	SW 4673 2851	Flush Bracket 1565 on wall S pier NW face 17.8m SW
Aux2	SW 4659 2841	F Bracket 1520 wall SE side of S Pier Rd NW face

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 3.05m below Ordnance Datum Newlyn (ODN)

TGZ = 7.801m below TGBM

Levelling Site was levelled on Day 220

Site visits

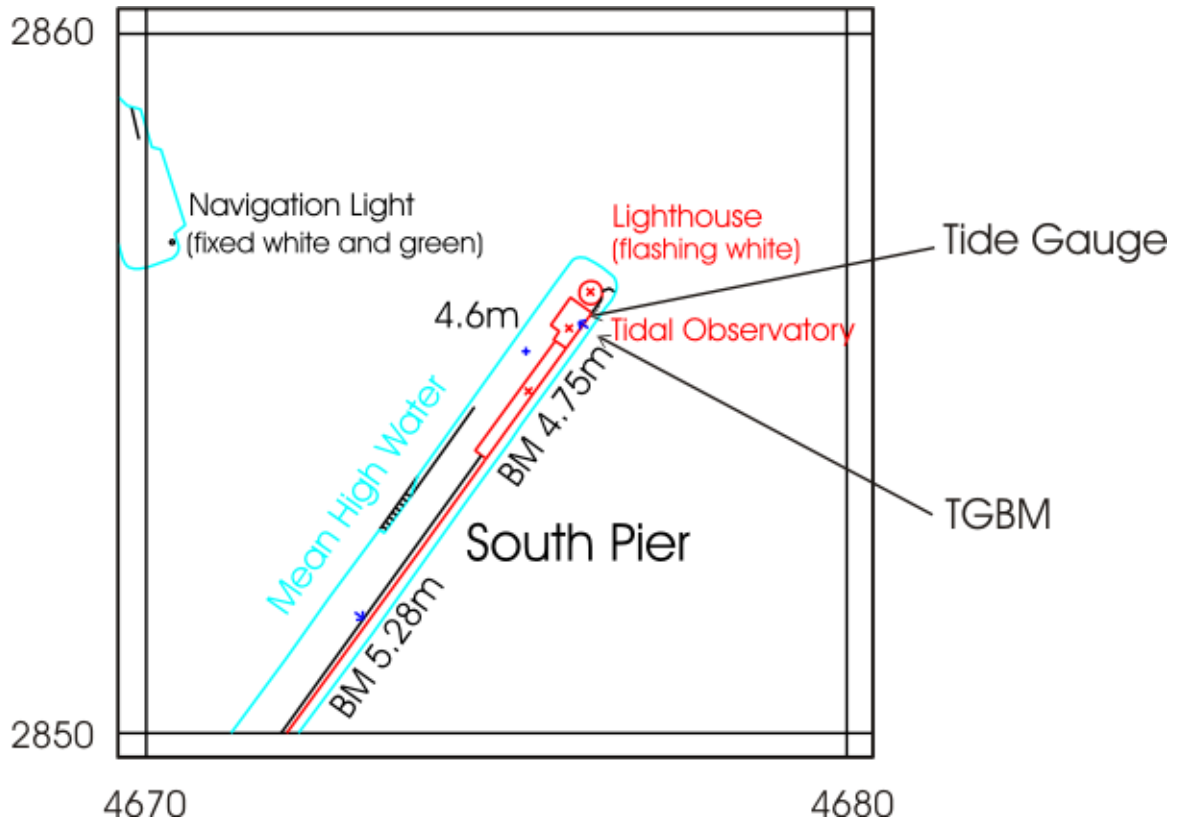
Day 061 Monitored progress of refurbishment work

Day 219-221 Oversaw electrical upgrade and Swantel telemetry system installation

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
98%	15 minutes	214-221	095

Newlyn – Map & Images of Site



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Newlyn – Statistics

Surge maxima	Value	Day	Time
January	0.665	5	18:30:00
February	0.075	25	06:45:00
March	0.241	8	01:15:00
April	0.616	25	18:15:00
May	0.28	10	05:30:00
June	0.502	7	21:30:00
July	0.295	7	22:45:00
August	0.449	15	16:45:00
September	0.493	24	12:45:00
October	0.523	17	05:15:00
November	0.591	4	10:15:00
December	0.598	25	11:30:00

Surge minima	Value	Day	Time
January	-0.401	12	09:15:00
February	-0.568	5	08:45:00
March	-0.494	14	00:30:00
April	-0.242	29	01:30:00
May	-0.359	12	13:45:00
June	-0.254	23	00:30:00
July	-0.247	23	00:45:00
August	-0.215	31	21:15:00
September	-0.292	6	12:15:00
October	-0.207	28	07:45:00
November	-0.459	23	05:00:00
December	-0.355	8	15:30:00

Extreme maxima	Value	Day	Time
January	6.882	13	01:15:00
February	6.63	25	01:00:00
March	6.988	11	00:45:00
April	7.221	9	12:45:00
May	7.094	6	23:15:00
June	7.024	7	13:15:00
July	6.883	4	23:45:00
August	6.92	20	12:45:00
September	7.162	18	12:30:00
October	7.436	17	12:00:00
November	7.111	15	11:45:00
December	7.188	14	11:30:00

Extreme minima	Value	Day	Time
January	0.518	25	19:00:00
February	0.616	7	17:15:00
March	0.183	9	18:15:00
April	0.284	8	18:30:00
May	0.436	8	06:30:00
June	0.544	5	05:30:00
July	0.657	5	06:15:00
August	0.705	3	06:00:00
September	0.569	18	06:30:00
October	0.54	16	17:45:00
November	0.512	15	18:15:00
December	0.674	15	18:45:00

Mean sea level	Days	MSL
January	31	3.626
February	12	*
March	31	3.488
April	30	3.693
May	28	3.630
June	30	3.672
July	31	3.674
August	31	3.715
September	30	3.706
October	31	3.793
November	30	3.794
December	31	3.760
	Sum	Avg
	346	3.664

Newport – Tide Gauge Information

Latitude 51° 33' 00.0" N **Longitude** 02° 59' 14.8" W **Grid Ref** ST 3163 8392

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** West side of the entrance to Newport Docks
Measuring Points Attached to the dock wall on the west side of the dock entrance, close to the lock gates

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	ST 3163 8392	Brass bolt adjacent to TG building
Aux1	ST 3160 8414	Pin in quay west side of South Lock
Aux2	ST 3160 8426	Pin in quay east side of South Lock
Aux3	ST 3147 8427	Pin in quay south west corner of South Dock

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 5.81m below Ordnance Datum Newlyn (ODN)
 TGZ = 14.525m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 247 Carried out general maintenance

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	069,083,088-118,234,261-276,286,288-311

Newport – Map & Images of Site



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Newport – Statistics

Surge maxima	Value	Day	Time
January	1.527	3	05:45:00
February	0.628	22	13:45:00
March	0.587	11	03:15:00
April	0.487	27	17:30:00
May	0.674	8	02:45:00
June	1.231	8	05:30:00
July	0.911	16	12:15:00
August	1.164	15	12:45:00
September	0.704	9	18:45:00
October	0.691	5	04:45:00
November	1.112	22	16:45:00
December	1	14	15:30:00

Surge minima	Value	Day	Time
January	-0.625	28	04:45:00
February	-0.944	11	04:45:00
March	-1.137	12	05:00:00
April	-0.83	29	10:45:00
May	-0.472	12	06:00:00
June	-0.568	4	01:30:00
July	-0.436	7	04:30:00
August	-0.397	22	17:00:00
September	-0.487	3	15:45:00
October	-0.375	14	00:30:00
November	-0.622	15	15:15:00
December	-0.594	8	07:45:00

Extreme maxima	Value	Day	Time
January	12.555	24	07:45:00
February	12.497	10	08:45:00
March	12.989	10	08:30:00
April	9.941	27	22:15:00
May	13.112	7	20:00:00
June	12.798	5	19:45:00
July	12.676	5	20:15:00
August	12.818	3	20:00:00
September	12.826	16	19:15:00
October	12.629	15	06:30:00
November	12.907	15	07:45:00
December	13.081	15	08:00:00

Extreme minima	Value	Day	Time
January	0.424	24	02:30:00
February	0.176	10	04:00:00
March	0.091	11	04:30:00
April	1.961	27	16:15:00
May	0.414	6	14:15:00
June	0.431	4	13:45:00
July	0.487	6	03:45:00
August	0.445	20	03:30:00
September	0.397	17	02:45:00
October	0.548	16	14:45:00
November	0.361	16	03:30:00
December	0.456	14	02:15:00

Mean sea level	Days	MSL
January	31	6.194
February	29	5.985
March	26	6.047
April	3	*
May	31	6.173
June	30	6.279
July	31	6.231
August	28	6.295
September	15	6.210
October	8	*
November	23	6.312
December	31	6.331
	Sum	Avg
	286	6.178

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

North Shields – Tide Gauge Information

Latitude 55° 00' 26.8" N **Longitude** 01° 26' 23.2" W **Grid Ref** NZ 3592 6823

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** North side of the River Tyne, close to the Port of Tyne Authority offices

Measuring Points As above

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NZ 3592 6823	Bolt adjacent to tide gauge building
Aux1	NZ 3626 6842	PA Bolt low lighthouse W face SW angle
Aux2	NZ 3630 6895	PA Bolt butt N side railway

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.60m below Ordnance Datum Newlyn (ODN)

TGZ = 6.754m below TGBM

Levelling No levelling was carried out in 2012

Site visits

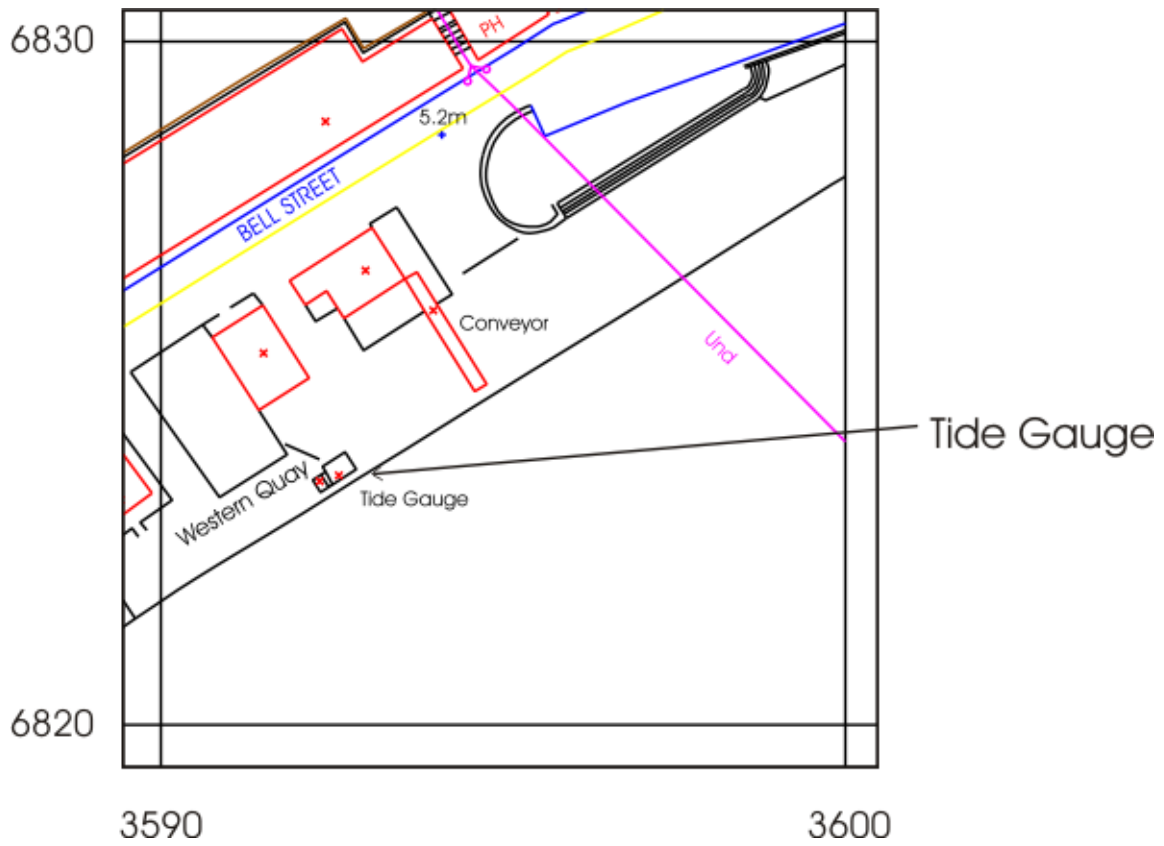
Day 012 Migrated to Swantel telemetry system and decommissioned DATARING logger

Day 169 Upgraded telemetry outstation hardware

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	012,031	012-013,066,071

North Shields – Map & Images of Site



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North Shields – Statistics

Surge maxima	Value	Day	Time
January	0.839	4	01:45:00
February	0.418	18	22:00:00
March	0.426	4	08:00:00
April	0.319	10	03:30:00
May	0.487	14	07:45:00
June	0.215	7	23:30:00
July	0.221	18	22:15:00
August	0.411	30	10:00:00
September	0.563	14	10:00:00
October	0.36	31	23:45:00
November	0.413	21	14:15:00
December	0.691	29	20:00:00

Surge minima	Value	Day	Time
January	-0.666	3	12:30:00
February	-0.601	10	13:45:00
March	-0.391	7	00:15:00
April	-0.299	30	19:30:00
May	-0.27	12	18:00:00
June	-0.162	23	03:00:00
July	-0.169	22	08:45:00
August	-0.307	27	18:30:00
September	-0.257	6	10:15:00
October	-0.252	12	23:00:00
November	-0.364	19	16:30:00
December	-0.605	23	11:00:00

Extreme maxima	Value	Day	Time
January	5.21	23	15:15:00
February	5.427	24	17:00:00
March	5.509	10	16:45:00
April	5.65	9	17:00:00
May	5.374	7	16:00:00
June	5.371	6	04:15:00
July	5.29	5	04:00:00
August	5.435	4	04:15:00
September	5.585	19	05:00:00
October	5.728	17	03:45:00
November	5.56	15	03:30:00
December	5.54	16	17:15:00

Extreme minima	Value	Day	Time
January	0.138	25	23:15:00
February	-0.034	10	23:30:00
March	0.065	8	22:00:00
April	0.152	7	22:00:00
May	0.346	8	10:45:00
June	0.45	6	10:45:00
July	0.424	5	10:30:00
August	0.446	3	10:15:00
September	0.442	1	10:00:00
October	0.47	15	09:00:00
November	0.595	14	09:15:00
December	0.428	14	22:15:00

Mean sea level	Days	MSL
January	29	2.964
February	29	2.818
March	31	2.853
April	30	2.940
May	31	2.892
June	30	2.948
July	31	2.953
August	31	2.986
September	30	3.045
October	31	3.056
November	30	3.098
December	31	2.993
	Sum	Avg
	364	2.962

Portbury – Tide Gauge Information

Latitude 51° 30' 00.0" N **Longitude** 02° 43' 42.5" W **Grid Ref** ST 4953 7815

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** Western, seaward side of the jetty

Measuring Points On the wall below the tide gauge cabinet

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark **Grid Ref** **Description**

TGBM ST 4953 7815 Brass bolt quay edge adjacent to tide gauge

AUX 1 ST 4986 7774 Brass pin coping stone SW corner Portbury Dock

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 6.50m below Ordnance Datum Newlyn (ODN)

TGZ = 9.226m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 055 Migrated to Swantel telemetry system and decommissioned DATARING logger

Day 253 Replaced compressor

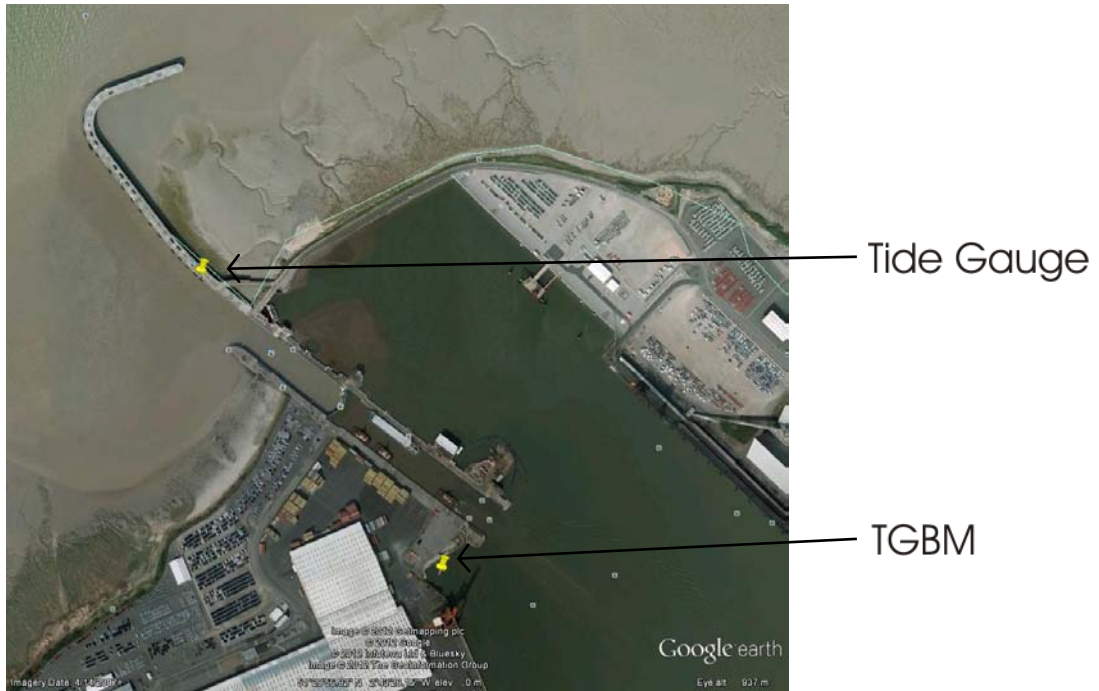
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
47%	15 minutes	054-246	001-054,247,260-261,263-264,288,306,336

Notes on Completeness/Quality

The primary channel sensor failed during October 2011 but replacement was postponed during the migration programme and the secondary channel was transferred to FFC in its place. The primary channel sensor was replaced on the 03/09/2012 and the transfer channel reverted to this sensor. The compressor tripped on several occasions, causing reduced availability of the secondary channel. However, availability at the site did not fall below 90% in any one month.

Portbury – Map & Images of Site



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Image © 2012 The Geoinformation Group



Portbury – Statistics

Surge maxima	Value	Day	Time
January			
February			
March			
April			
May			
June			
July			
August			
September	0.941	9	19:15:00
October	0.903	31	15:30:00
November	1.315	22	15:45:00
December	0.877	14	17:00:00

Surge minima	Value	Day	Time
January			
February			
March			
April			
May			
June			
July			
August			
September	-0.835	12	23:15:00
October	-0.826	12	11:00:00
November	-0.749	27	17:00:00
December	-0.919	7	23:00:00

Extreme maxima	Value	Day	Time
January			
February			
March			
April			
May			
June			
July			
August			
September	14.257	17	20:00:00
October	14.681	17	08:00:00
November	14.082	15	07:45:00
December	14.275	15	08:15:00

Extreme minima	Value	Day	Time
January			
February			
March			
April			
May			
June			
July			
August			
September	0.705	18	15:30:00
October	0.766	17	03:00:00
November	0.573	15	15:00:00
December	0.916	14	02:15:00

Mean sea level	Days	MSL
January	0	*
February	0	*
March	0	*
April	0	*
May	0	*
June	0	*
July	0	*
August	0	*
September	21	7.090
October	21	7.202
November	29	7.170
December	31	7.158
	Sum	Avg
	102	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Portpatrick – Tide Gauge Information

Latitude 54° 50' 33.2" N **Longitude** 05° 07' 12.1" W **Grid Ref** NW 9976 5421

Instrument Data acquisition system with a full-tide bubbler gauge and a potentiometer attached to a Munro float gauge

Location **Tide Gauge Building** The western corner of Portpatrick harbour
Measuring Points The stilling well is directly underneath the tide gauge building

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NW 9976 5421	Bolt Harbour wall 13.84M NE angle of building
Aux1	NW 9977 5411	Rivet E side of Jetty wall 16.6M SE angle Lifeboat HQ
Aux2	NW 9995 5412	Rivet S angle No 53 Main St
Aux3	NX 0006 5423	Church hall SE side of Rd W angle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 1.80m below Ordnance Datum Newlyn (ODN)

TGZ = 6.827m below TGBM

Levelling No levelling was carried out in 2012

Site visits

No site visits in 2012

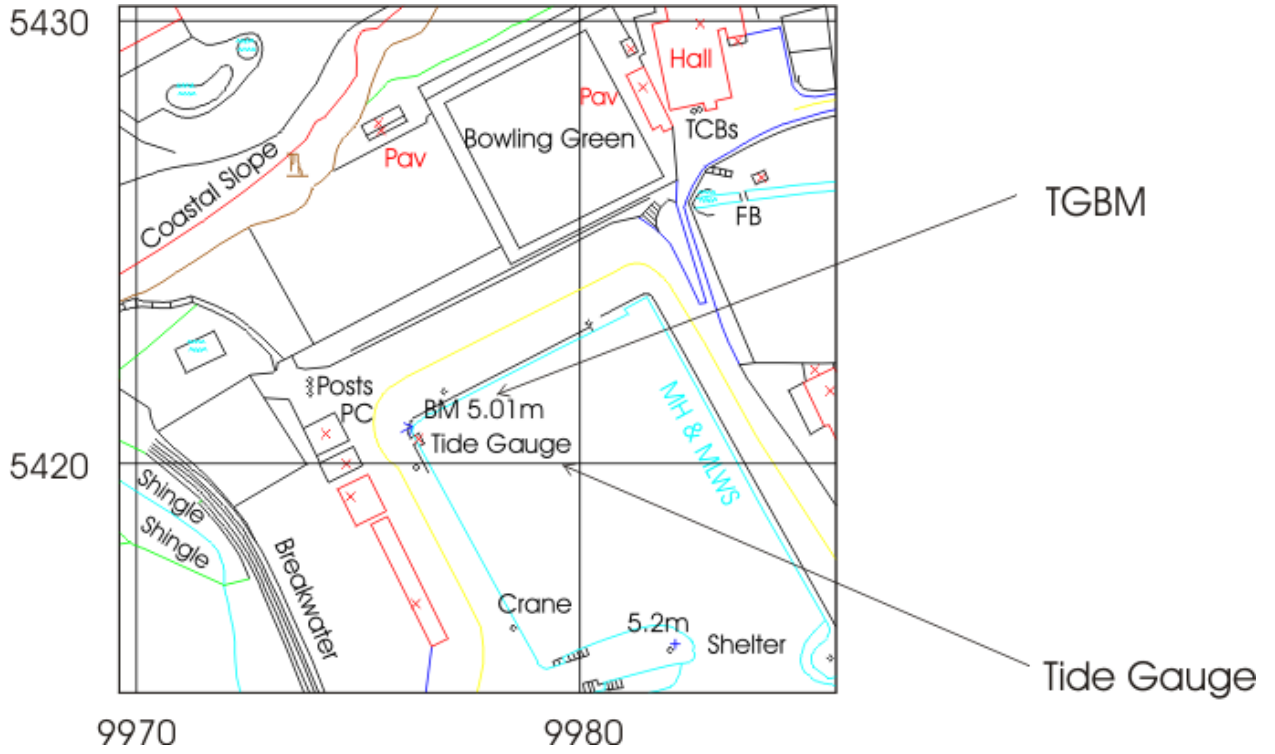
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
100%	15 minutes	None	056,074-080,183-213

Notes on Completeness/Quality

All the data for the primary channel at this site were flagged as suspect. The primary channel (float gauge) was reading 50-120mm low. The stilling well had become buried in sediment, requiring an additional aperture to be cut into the side of the well above the level of the silt. This work was postponed until completion of the migration programme, since the secondary channel was not affected.

Portpatrick – Map & Images of Site



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Portpatrick – Statistics

No statistics could be calculated as all data for the primary channel was subsequently flagged as unreliable for the purposes of long-term sea level monitoring. The secondary channel was generally functional during this time.

Portrush – Tide Gauge Information

Latitude 55° 12' 24.4" N **Longitude** 06° 39' 24.6" W **Grid Ref** NW 0416 9952

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** Portrush RNLI boathouse

Measuring Points Fixed to a leg of the boathouse slipway

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NR 0385 0018	Pin RNLI slipway
Aux1	NR 0395 0008	Cut mark wall Kerr St
Aux2	NW 0406 9992	Cut mark wall Kerr St

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 1.24m below Ordnance Datum Belfast (ODB)

TGZ = 2.844m below TGBM

Levelling No levelling was carried out in 2012

Site visits

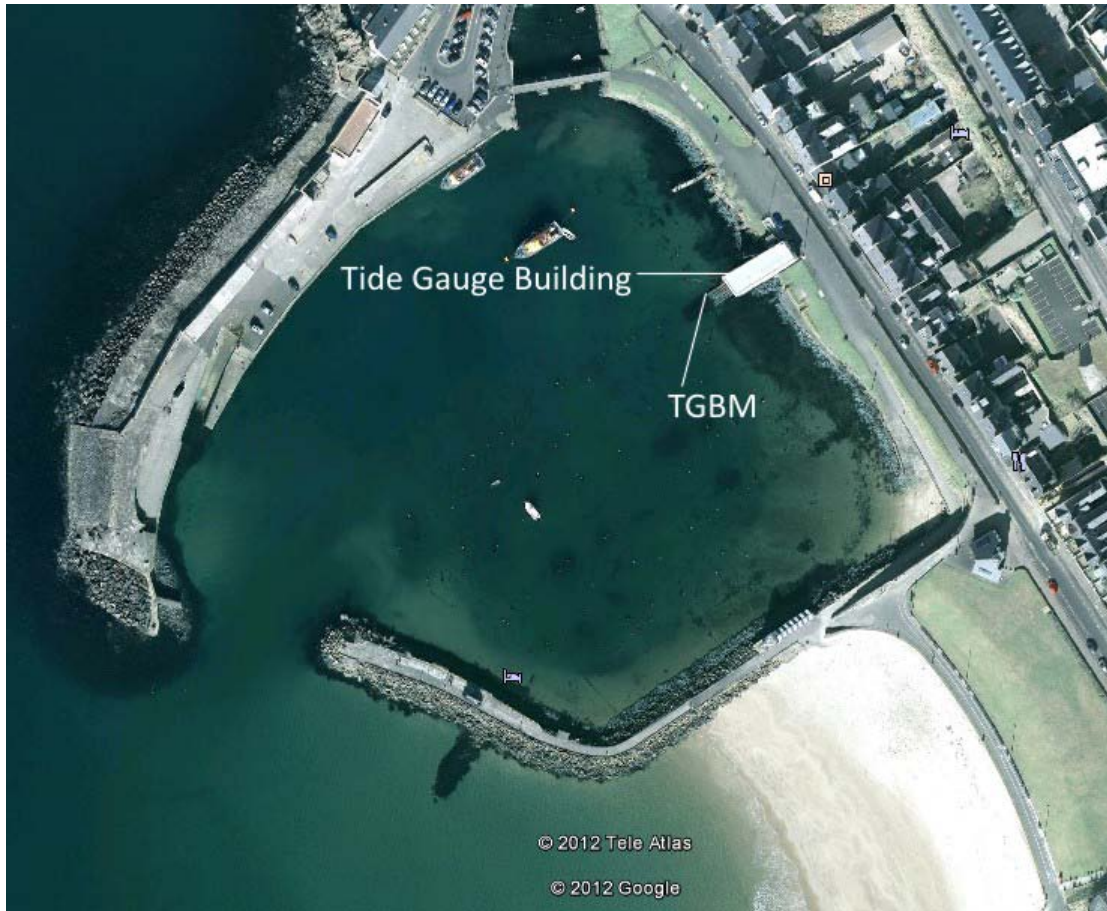
Day 144 Upgraded telemetry outstation hardware and replaced compressor

Day 262 Cleaned and serviced all three channels

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
100%	15 minutes	None	006,036,063,078,144,262

Portrush – Map & Images of Site



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Portrush – Statistics

Surge maxima	Value	Day	Time
January	1.154	3	07:15:00
February	0.283	22	11:00:00
March	0.403	3	14:45:00
April	0.471	17	03:45:00
May	0.52	13	19:15:00
June	0.304	29	13:30:00
July	0.21	22	18:45:00
August	0.445	27	12:30:00
September	0.312	14	04:00:00
October	0.418	31	01:15:00
November	0.575	19	10:45:00
December	0.725	29	02:30:00

Surge minima	Value	Day	Time
January	-0.408	5	22:15:00
February	-0.478	14	02:45:00
March	-0.361	5	11:15:00
April	-0.434	4	11:30:00
May	-0.322	1	00:00:00
June	-0.161	3	21:15:00
July	-0.224	25	14:30:00
August	-0.261	30	13:00:00
September	-0.285	26	13:00:00
October	-0.275	26	23:45:00
November	-0.475	27	14:30:00
December	-0.503	5	09:00:00

Extreme maxima	Value	Day	Time
January	2.488	25	07:45:00
February	2.409	22	06:45:00
March	2.365	9	06:45:00
April	2.459	9	20:15:00
May	2.439	7	19:15:00
June	2.448	6	20:00:00
July	2.478	4	19:00:00
August	2.655	1	18:15:00
September	2.563	17	19:15:00
October	2.565	17	19:45:00
November	2.672	19	10:45:00
December	2.805	15	07:30:00

Extreme minima	Value	Day	Time
January	0.071	13	02:30:00
February	-0.026	10	01:15:00
March	-0.125	11	01:45:00
April	0.047	7	12:45:00
May	0.135	5	11:45:00
June	0.231	4	12:00:00
July	0.291	6	14:00:00
August	0.25	30	11:30:00
September	0.223	18	13:15:00
October	0.362	18	13:45:00
November	0.29	15	00:45:00
December	0.401	10	22:30:00

Mean sea level	Days	MSL
January	30	1.278
February	29	1.107
March	29	1.127
April	30	1.186
May	26	1.198
June	30	1.269
July	31	1.253
August	31	1.342
September	30	1.318
October	31	1.371
November	30	1.407
December	31	1.406
	Sum	Avg
	358	1.272

Portsmouth – Tide Gauge Information

Latitude 50° 48' 08.1" N **Longitude** 01° 06' 40.5" W **Grid Ref** SU 6273 0068

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** Victory Jetty in Portsmouth Royal Naval base

Measuring Points On a leg at the north west corner of the jetty

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SU 6269 0053	Bolt in concrete jetty TG building S angle
Aux1	SU 6330 9996	GP N side entrance to HMS Vernon
Aux2	SU 6274 0039	Building SW face 0.6M S angle
Aux3	SU 6283 0050	Building SW side of Main Rd NE face N angle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.73m below Ordnance Datum Newlyn (ODN)

TGZ = 6.007m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 083 Migrated to Swantel telemetry system and decommissioned DATARING logger

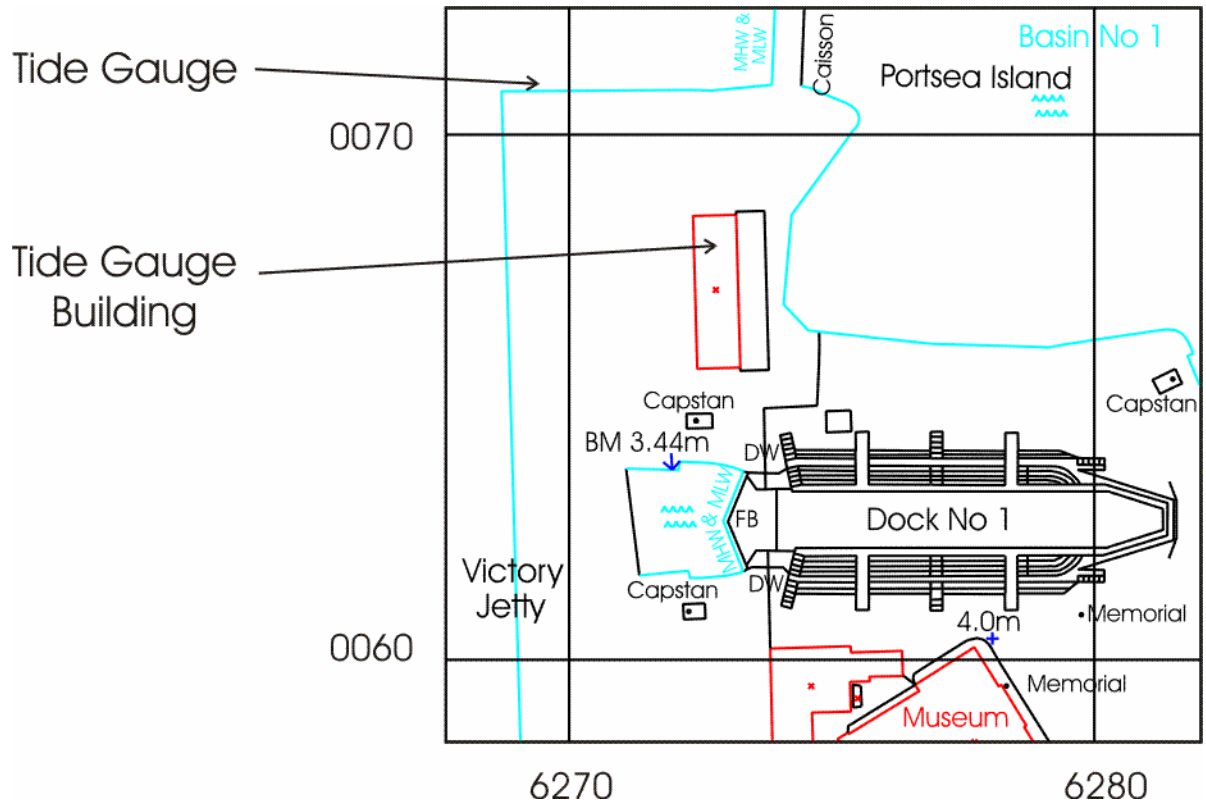
Day 088 Replaced charger and carried out pressure testing

Day 311 Replaced faulty telemetry outstation hardware

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	081-083,089,295	083,089-090,160,203,234-242,249,263-264,277,281,283,289-311,359-366

Portsmouth – Map & Images of Site



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Portsmouth – Statistics

Surge maxima	Value	Day	Time
January	0.524	5	19:15:00
February	0.164	19	12:30:00
March	0.232	7	23:00:00
April	0.792	25	17:45:00
May	0.367	10	05:45:00
June	0.597	7	17:45:00
July	0.364	7	18:00:00
August	0.43	15	13:30:00
September	0.368	24	08:00:00
October	0.314	5	05:15:00
November	0.48	25	01:30:00
December	0.498	24	13:45:00

Surge minima	Value	Day	Time
January	-0.361	9	00:15:00
February	-0.555	5	10:15:00
March	-0.367	11	13:00:00
April	-0.215	1	06:45:00
May	-0.344	12	15:00:00
June	-0.231	8	15:30:00
July	-0.188	23	01:15:00
August	-0.183	31	22:45:00
September	-0.247	6	14:00:00
October	-0.12	12	09:30:00
November	-0.372	25	11:15:00
December	-0.361	7	05:15:00

Extreme maxima	Value	Day	Time
January	4.852	21	22:00:00
February	4.65	23	12:15:00
March	4.871	7	23:00:00
April	5.173	10	01:15:00
May	5.024	8	00:15:00
June	5.111	8	01:30:00
July	4.929	7	13:45:00
August	4.93	4	12:45:00
September	5.036	17	12:00:00
October	5.034	15	10:45:00
November	5.034	16	12:45:00
December	5.281	14	11:15:00

Extreme minima	Value	Day	Time
January	0.554	11	18:00:00
February	0.101	10	18:30:00
March	0.097	10	18:00:00
April	0.32	8	17:45:00
May	0.501	7	05:00:00
June	0.556	5	04:45:00
July	0.649	6	06:00:00
August	0.68	20	06:00:00
September	0.539	18	05:30:00
October	0.897	15	03:45:00
November	0.52	15	17:15:00
December	0.76	13	16:15:00

Mean sea level	Days	MSL
January	31	2.845
February	29	2.652
March	22	2.693
April	30	2.938
May	31	2.859
June	30	2.917
July	31	2.909
August	21	2.950
September	26	2.934
October	14	*
November	23	2.993
December	23	2.952
	Sum	Avg
	311	2.877

* No mean sea level value as more than 15 days of data missing

Sheerness – Tide Gauge Information

Latitude 51° 26' 44.3" N **Longitude** 00° 44' 36.4" E **Grid Ref** TQ 9074 7542

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge
Location **Tide Gauge Building** On the jetty at Garrison Point, Port of Sheerness
Measuring Points As above

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	TQ 9080 7549	Flush bracket 11859, Garrison Fort, S angle, SW building
Aux1	TQ 9133 7532	Flush bracket G.4790, on house, NW angle, N face
Aux2	TQ 9115 7533	Wall on SW side of road, NE angle
Aux3	TQ 9147 7516	Bolt Ch. Dis, SW side of road, E face, NE angle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 2.90m below Ordnance Datum Newlyn (ODN)
 TGZ = 7.532m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 026 Installed S500 logger, migrated to Swantel telemetry system and decommissioned DATARING logger

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	026,031	001-026,026-031,031-366

Notes on Completeness/Quality

All the data for the primary channel at this site were flagged as suspect. The primary channel was under-recording at high water and over-recording at low water. The suspected cause is biofouling of underwater equipment.

Sheerness – Map & Images of Site



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Sheerness – Statistics

No statistics could be calculated as all data for the primary channel was subsequently flagged as unreliable for the purposes of long-term sea level monitoring. The secondary channel was generally functional during this time.

St Mary's (Isles of Scilly) – Tide Gauge Information

Latitude 49° 55' 04.3" N **Longitude** 06° 19' 02.0" W **Grid Ref** SV 9021 1090

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge
Location **Tide Gauge Building** Cabinet in the Harbour Office storeroom on the quay, Hugh Town
Measuring Points End of the quay

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	N/A	Bolt by VTS
Aux1	N/A	Bolt by VTS 2
Aux2	N/A	Bolt by top of steps
Aux3	N/A	Bolt by top of steps
Aux4	SV 9028 1097	Point above pressure points
Aux5	SV 9014 1071	Cut Mark east angle Mermaid Inn
Aux6	SV 9007 1065	Cut Mark Guard House top of Garrison Hill
VTS	SV 9023 1091	Tide staff 7.210 metre mark
VTS2	N/A	Tide staff 7.245 metre mark

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 2.91m below Ordnance Datum Local (ODL)
 TGZ = 7.425m below TGBM
 TGZ = 7.399m below Aux 1
 TGZ = 6.776m below Aux 2

Levelling No levelling was carried out in 2012

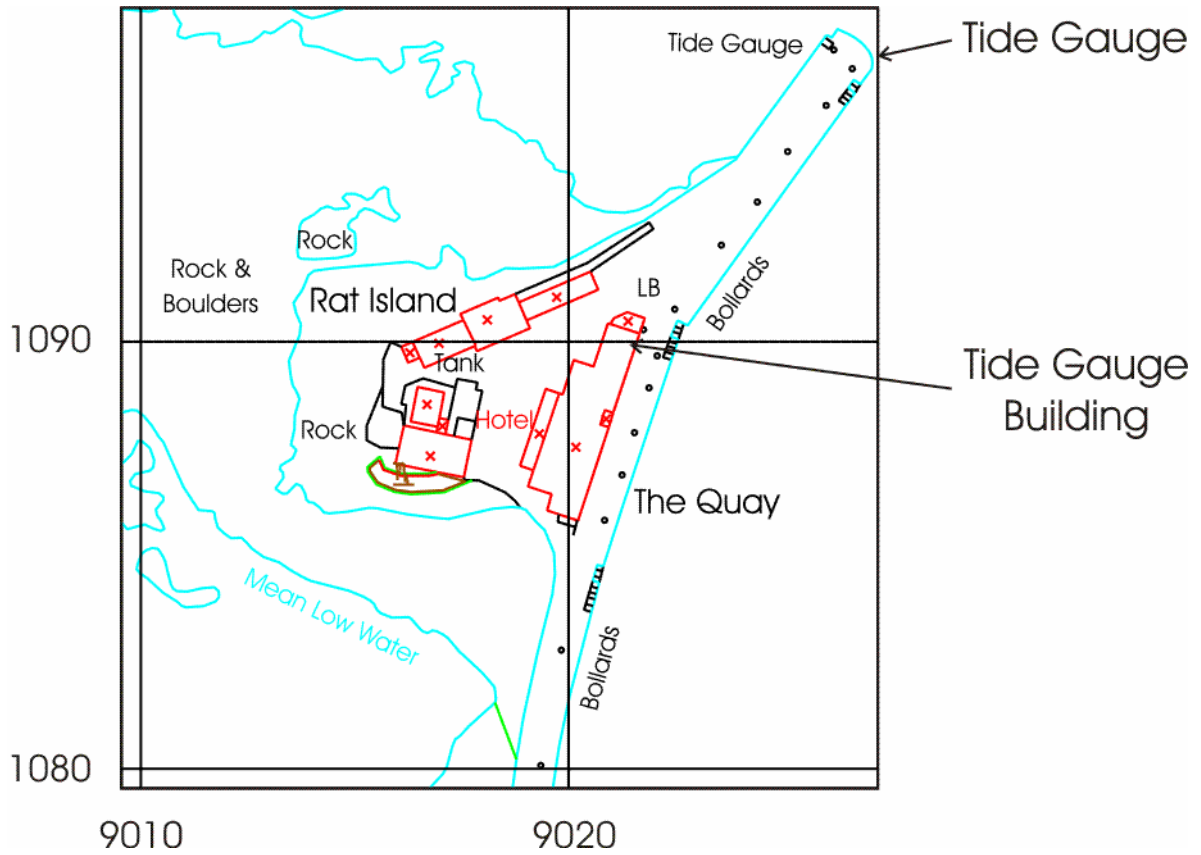
Site visits

Day 088 Supervised electrical survey and installation, installed S500 logger, migrated to Swantel telemetry system and decommissioned DATARING logger
 Day 219 Carried out electrical enabling work

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	087-088,096,149	089,100-101,111,124-125,128,150-151,159,162-163,166,168,170,172-173,182-183,188,196,204-217,219-267,280-305,321-322,332-338,351-352

St Mary's (Isles of Scilly) – Map & Images of Site



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St Mary's (Isles of Scilly) – Statistics

Surge maxima	Value	Day	Time
January	0.181	3	06:30:00
February	-0.022	1	07:15:00
March	0.063	17	20:30:00
April	0.53	25	12:30:00
May	0.255	9	23:30:00
June	0.427	7	07:15:00
July	0.254	7	15:30:00
August	0.231	4	19:30:00
September	0.291	26	09:30:00
October	0.376	31	22:00:00
November	0.382	1	00:30:00
December	0.414	14	09:45:00

Surge minima	Value	Day	Time
January	-0.326	11	15:45:00
February	-0.401	13	17:00:00
March	-0.359	11	16:15:00
April	-0.165	4	23:45:00
May	-0.245	12	19:45:00
June	-0.108	22	17:45:00
July	-0.12	22	03:15:00
August	-0.019	8	06:15:00
September	-0.083	29	16:00:00
October	-0.074	1	04:15:00
November	-0.165	6	20:00:00
December	-0.317	8	10:00:00

Extreme maxima	Value	Day	Time
January	5.833	25	06:00:00
February	5.726	10	06:00:00
March	5.848	10	05:45:00
April	6.071	8	05:30:00
May	6.063	6	16:45:00
June	6.052	6	18:00:00
July	5.996	5	17:45:00
August	5.993	4	18:15:00
September	5.702	30	16:45:00
October	5.738	31	05:15:00
November	6.072	16	06:00:00
December	6.377	14	04:45:00

Extreme minima	Value	Day	Time
January	0.559	11	12:15:00
February	0.285	10	12:30:00
March	0.02	10	12:15:00
April	0.228	8	11:45:00
May	0.505	6	23:00:00
June	0.578	4	23:00:00
July	0.662	6	00:15:00
August	0.84	5	00:45:00
September	0.779	29	22:30:00
October	0.895	1	11:30:00
November	0.432	15	11:30:00
December	0.747	15	12:15:00

Mean sea level	Days	MSL
January	31	3.116
February	29	2.968
March	26	3.016
April	23	3.253
May	22	3.173
June	19	3.218
July	16	3.220
August	1	*
September	6	*
October	4	*
November	23	3.338
December	25	3.302
	Sum	Avg
	225	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Stornoway – Tide Gauge Information

Latitude 58° 12' 28.1" N **Longitude** 06° 23' 20.3" W **Grid Ref** NB 4228 3274

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** By the weighbridge at the entrance to Stornoway Port Authority, No. 2 wharf

Measuring Points Attached to a leg on the east side of the wharf

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NB 4228 3264	OSBM bolt E side of No 2 wharf
Aux1	NB 4215 3271	OSBM bolt STS NE angle King Edwards Wharf
Aux2	NB 4212 3275	Amity House E side of Espl Rd N face NW angle
Aux3	NB 4223 3280	BK S side Worth Beach NW angle N face

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.71m below Ordnance Datum Local (ODL)

TGZ = 6.368m below TGBM

Levelling Site was levelled on Day 072

Site visits

Day 072 Pneumatic lines refurbished by dive team; connected retained DATARING logger to broadband

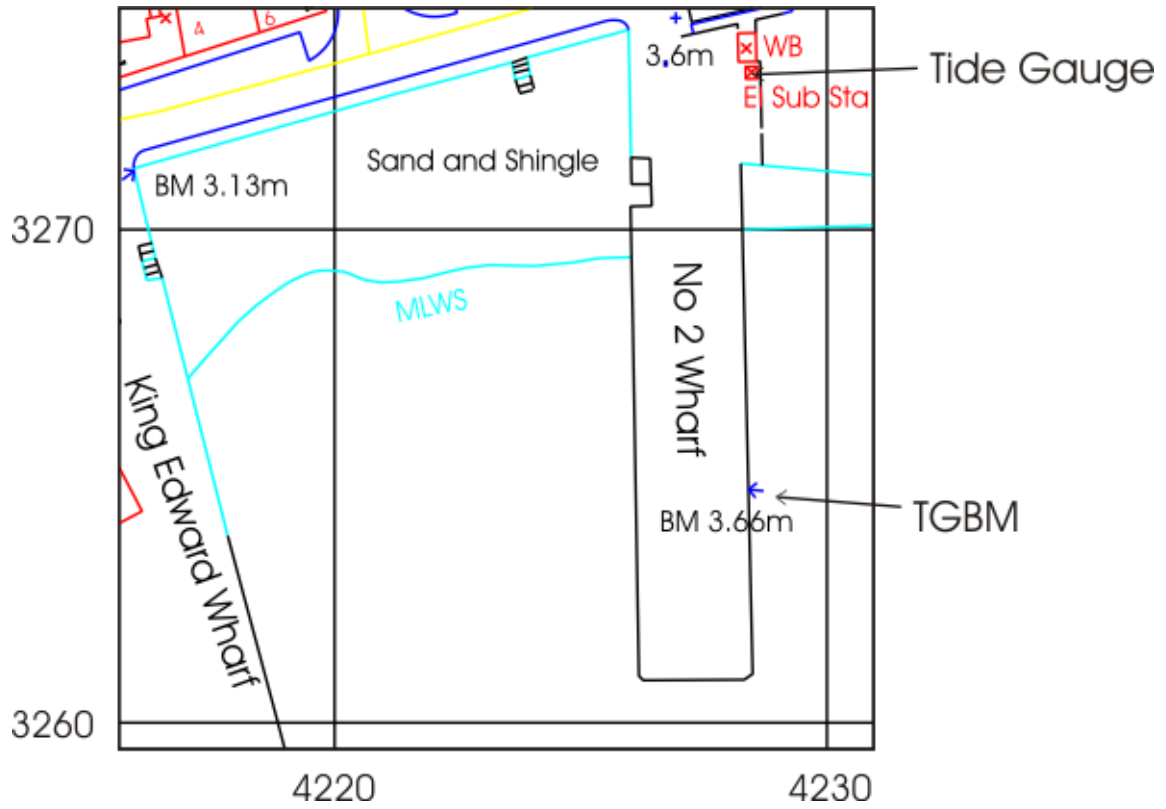
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	001-071

Notes on Completeness/Quality

Both channels were under-recording following the severance of the pneumatic lines during the electrical enabling works, as it was not possible to drain residual seawater from the tubing. Replacement of the pressure points lines along the full length of the pier was completed in March 2012.

Stornoway – Map & Images of Site



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Stornoway – Statistics

Surge maxima	Value	Day	Time
January			
February			
March	0.204	17	03:45:00
April	0.417	17	12:15:00
May	0.545	13	23:30:00
June	0.33	29	10:45:00
July	0.281	22	12:00:00
August	0.447	27	17:00:00
September	0.45	13	19:45:00
October	0.434	30	22:45:00
November	0.454	19	18:30:00
December	0.712	29	09:45:00

Surge minima	Value	Day	Time
January			
February			
March	-0.281	12	17:30:00
April	-0.344	30	08:45:00
May	-0.308	1	01:15:00
June	-0.106	13	13:45:00
July	-0.184	7	12:30:00
August	-0.183	31	01:15:00
September	-0.25	25	23:30:00
October	-0.257	27	02:00:00
November	-0.434	27	13:30:00
December	-0.381	8	03:45:00

Extreme maxima	Value	Day	Time
January			
February			
March	4.736	12	09:15:00
April	5.355	8	20:00:00
May	5.165	7	19:45:00
June	5.198	6	20:15:00
July	5.155	4	19:15:00
August	5.234	1	18:15:00
September	5.402	17	19:30:00
October	5.326	16	19:00:00
November	5.308	15	07:15:00
December	5.664	15	08:00:00

Extreme minima	Value	Day	Time
January			
February			
March	0.127	11	15:00:00
April	0.126	7	13:15:00
May	0.292	6	13:00:00
June	0.544	5	01:00:00
July	0.421	6	02:30:00
August	0.548	4	02:15:00
September	0.342	19	02:45:00
October	0.445	17	01:30:00
November	0.461	15	01:15:00
December	0.781	14	01:00:00

Mean sea level	Days	MSL
January	0	*
February	0	*
March	19	2.777
April	30	2.815
May	31	2.783
June	30	2.855
July	31	2.852
August	31	2.956
September	30	2.986
October	31	2.988
November	30	3.073
December	31	3.035
	Sum	Avg
	294	**

* No mean sea level value as more than 15 days of data missing

** No yearly average value as more than one month's MSL missing

Tobermory – Tide Gauge Information

Latitude 56° 37' 23.2" N **Longitude** 06° 03' 51.2" W **Grid Ref** NM 5079 5531

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** In the Caledonian MacBrayne ferry terminal on Mishnish Pier

Measuring Points Attached to a leg of the pier

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NM 5069 5530	F bracket G5186 on SW angle of Royal bldg
Aux2	NM 5077 5529	NBM rivet in sea wall of Mishnish Pier

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.39m below Ordnance Datum Newlyn (ODN)

TGZ = Chart Datum = 6.856m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 072 Installed S500 logger, migrated to Swantel telemetry system, decommissioned DATARING logger, carried out general maintenance and replaced compressor

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	046	046,266-267

Tobermory – Map & Images of Site



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Tobermory – Statistics

Surge maxima	Value	Day	Time
January	1.14	3	07:45:00
February	0.278	22	09:30:00
March	0.48	3	15:00:00
April	0.459	17	02:45:00
May	0.552	13	17:30:00
June	0.321	29	15:00:00
July	0.261	22	18:15:00
August	0.494	27	14:30:00
September	0.468	13	19:15:00
October	0.512	30	22:45:00
November	0.575	19	10:30:00
December	0.974	29	00:15:00

Surge minima	Value	Day	Time
January	-0.564	5	22:30:00
February	-0.561	14	17:45:00
March	-0.333	13	03:45:00
April	-0.443	4	11:30:00
May	-0.26	1	00:00:00
June	-0.118	2	03:00:00
July	-0.185	25	14:30:00
August	-0.225	30	23:45:00
September	-0.312	26	04:30:00
October	-0.264	27	04:30:00
November	-0.508	27	12:45:00
December	-0.491	7	19:45:00

Extreme maxima	Value	Day	Time
January	4.908	25	07:00:00
February	4.786	22	06:15:00
March	4.981	9	06:30:00
April	5.024	8	19:00:00
May	4.907	7	18:45:00
June	4.902	5	18:30:00
July	4.881	4	18:30:00
August	4.994	1	17:30:00
September	5.13	17	18:30:00
October	5.076	17	06:45:00
November	4.955	16	07:00:00
December	5.329	15	07:00:00

Extreme minima	Value	Day	Time
January	0.452	13	02:15:00
February	0.242	10	01:15:00
March	0.031	11	01:45:00
April	0.206	8	00:30:00
May	0.389	7	00:15:00
June	0.579	4	11:45:00
July	0.604	6	13:45:00
August	0.62	4	13:30:00
September	0.442	18	13:15:00
October	0.575	17	00:45:00
November	0.5	15	00:30:00
December	0.811	14	00:15:00

Mean sea level	Days	MSL
January	31	2.738
February	26	2.585
March	31	2.585
April	30	2.622
May	31	2.631
June	30	2.712
July	31	2.697
August	31	2.798
September	27	2.786
October	31	2.819
November	30	2.886
December	31	2.869
	Sum	Avg
	360	2.727

Ullapool – Tide Gauge Information

Latitude 57° 53' 42.9" N **Longitude** 05° 09' 28.4" W **Grid Ref** NH 1293 9391

Instrument Data acquisition system with a full-tide and a mid-tide bubbler gauge and a back-up potentiometer attached to a Munro float gauge

Location **Tide Gauge Building** On the Ullapool harbour pier

Measuring Points Below the tide gauge building

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NH 1288 9391	OSBM Pier NW Para 8.2M NE steps
Aux1	NH 1303 9425	PA bolt Church SW side of road NE face N angle
Aux2	NH 1288 9398	No 8 Shore Street SE face 0.3M S angle
Aux3	NH 1253 9376	Rivet Fnd No 21 West Shore Street S angle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.75m below Ordnance Datum Newlyn (ODN)

TGZ = 7.155m below TGBM

Levelling No levelling was carried out in 2012

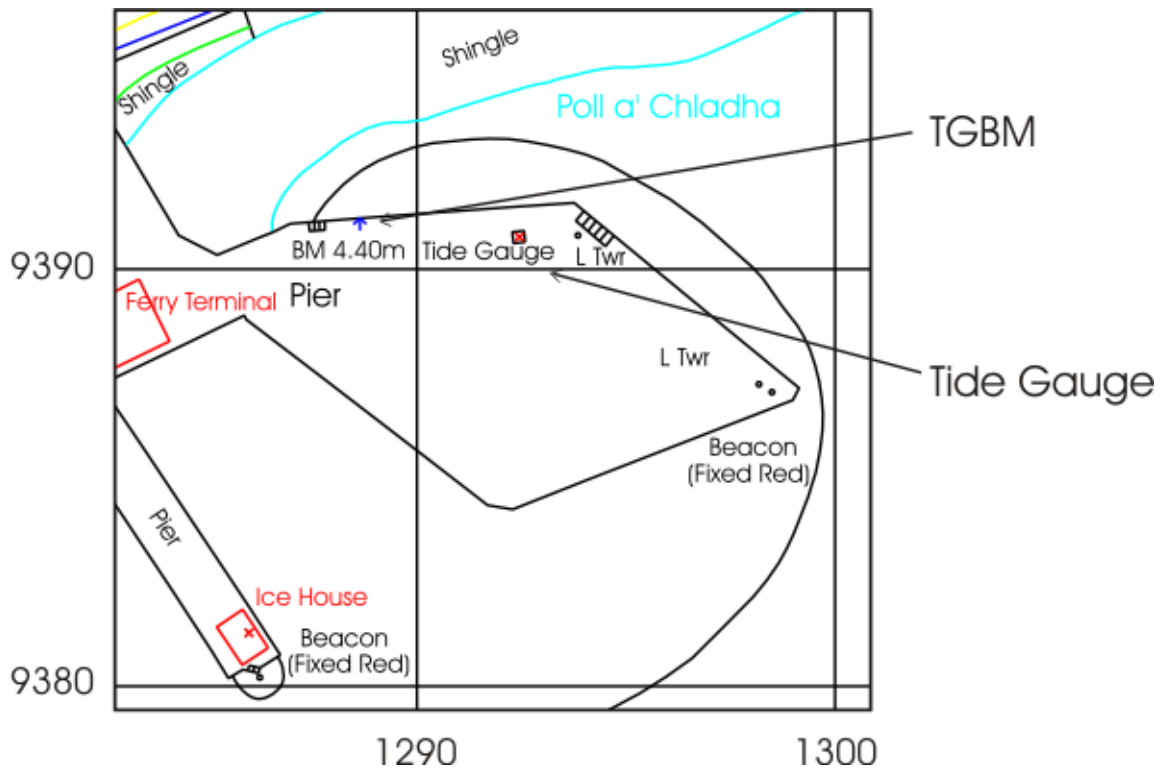
Site visits

Day 074 Replaced compressor

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	072

Ullapool – Map & Images of Site



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Ullapool – Statistics

Surge maxima	Value	Day	Time
January	0.626	3	08:30:00
February	0.264	23	14:30:00
March	0.512	7	00:00:00
April	0.407	17	13:00:00
May	0.635	13	22:45:00
June	0.331	29	10:45:00
July	0.286	22	12:30:00
August	0.48	27	18:00:00
September	0.561	13	19:00:00
October	0.439	30	23:00:00
November	0.552	19	18:30:00
December	0.825	29	07:15:00

Surge minima	Value	Day	Time
January	-0.532	6	00:30:00
February	-0.62	13	18:00:00
March	-0.328	5	12:30:00
April	-0.413	30	20:30:00
May	-0.362	1	01:15:00
June	-0.182	4	09:30:00
July	-0.224	7	12:00:00
August	-0.246	30	14:45:00
September	-0.388	25	23:30:00
October	-0.308	27	01:30:00
November	-0.497	27	19:30:00
December	-0.474	7	21:45:00

Extreme maxima	Value	Day	Time
January	5.584	25	08:15:00
February	5.476	22	07:15:00
March	5.762	9	07:45:00
April	5.75	8	20:00:00
May	5.496	7	19:45:00
June	5.485	6	20:15:00
July	5.428	4	19:15:00
August	5.538	1	18:30:00
September	5.72	17	19:30:00
October	5.688	16	07:00:00
November	5.633	15	07:15:00
December	5.997	15	07:45:00

Extreme minima	Value	Day	Time
January	0.597	13	16:00:00
February	0.21	11	15:30:00
March	0.016	10	14:30:00
April	0.162	7	13:30:00
May	0.305	6	13:00:00
June	0.518	5	01:15:00
July	0.428	6	02:30:00
August	0.56	4	02:15:00
September	0.379	19	02:45:00
October	0.416	17	01:45:00
November	0.467	15	01:30:00
December	0.786	14	01:15:00

Mean sea level	Days	MSL
January	31	3.147
February	29	2.974
March	29	2.983
April	30	2.974
May	31	2.956
June	30	3.011
July	31	3.020
August	31	3.116
September	30	3.152
October	31	3.158
November	30	3.251
December	31	3.212
	Sum	Avg
	364	3.080

Weymouth – Tide Gauge Information

Latitude 50° 36' 30.6" N **Longitude** 02° 26' 52.6" W **Grid Ref** SY 6840 7885

Instrument Data acquisition system with two full-tide bubbler gauges
Location **Tide Gauge Building** Commercial Pier, next to the ferry terminal
Measuring Points On the pier wall, directly in front of the tide gauge building

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	SY 6826 7882	Bolt corner of quay wall NW side N angle
Aux1	SY 6822 7886	Bolt sea wall 5.5M W steps
Aux2	SY 6813 7888	Right base NW pillar NE entrance Alexandra gardens
Aux3	SY 6810 7893	Bolt sea wall 10.1M NW shelter
Aux4	SY 6806 7908	Bolt N base STS aquarium E side of esplanade
REFBM	SY 6837 7884	Bolt concrete SW corner of building next to tide gauge hut

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)
 TGZ = 1.02m below Ordnance Datum Newlyn (ODN)
 TGZ = 4.334m below TGBM

Levelling No levelling was carried out in 2012

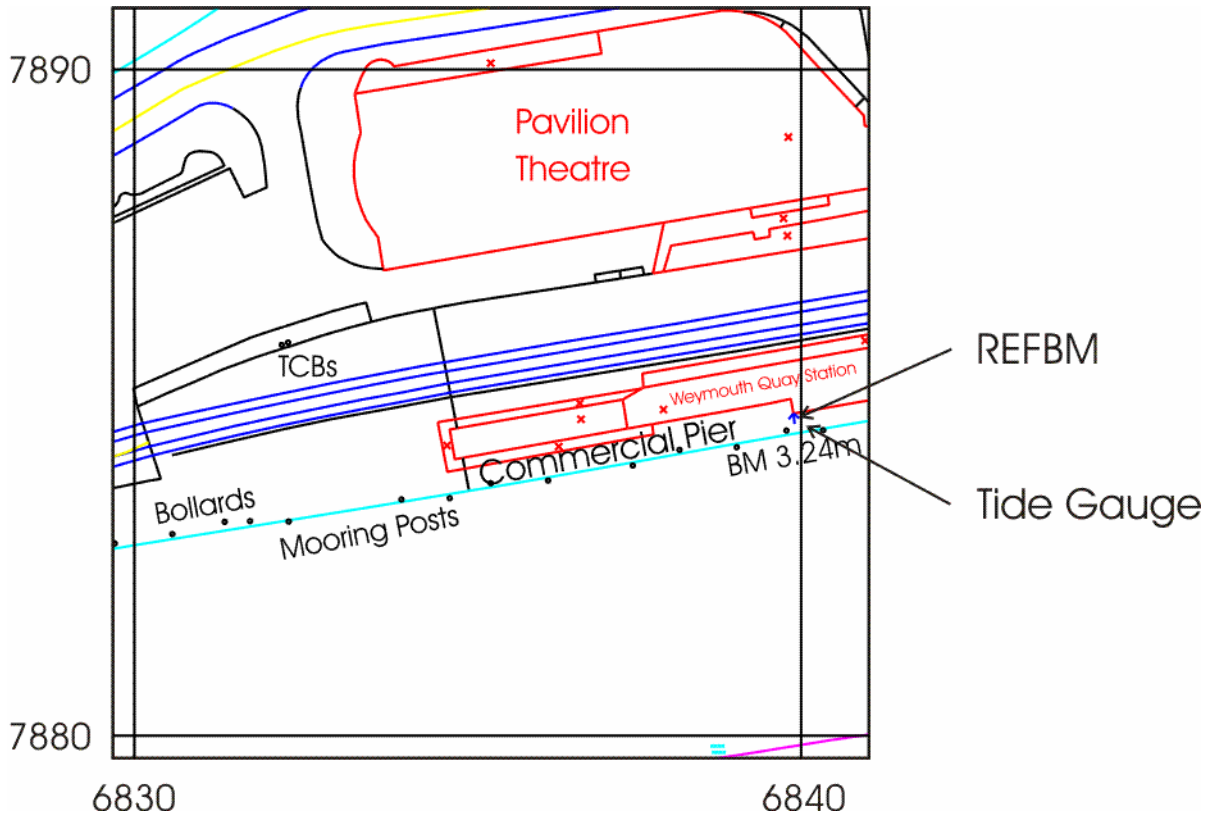
Site visits

Day 038 Replaced compressor
 Day 166 Carried out general maintenance

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031,076	015,026,073,076,166,226,291-305,307-309,349-350

Weymouth – Map & Images of Site



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Weymouth – Statistics

Surge maxima	Value	Day	Time
January	0.271	4	09:00:00
February	0.003	19	12:30:00
March	0.127	31	17:15:00
April	0.704	25	16:00:00
May	0.246	9	22:15:00
June	0.569	7	16:30:00
July	0.329	7	17:15:00
August	0.384	15	11:00:00
September	0.327	23	23:45:00
October	0.414	31	17:00:00
November	0.426	24	23:00:00
December	0.47	25	09:00:00

Surge minima	Value	Day	Time
January	-0.399	10	13:30:00
February	-0.512	5	11:00:00
March	-0.442	11	13:30:00
April	-0.225	6	00:30:00
May	-0.362	12	16:30:00
June	-0.227	23	02:45:00
July	-0.201	23	01:45:00
August	-0.223	31	23:45:00
September	-0.254	6	16:00:00
October	-0.141	12	10:15:00
November	-0.359	23	07:15:00
December	-0.398	8	10:00:00

Extreme maxima	Value	Day	Time
January	2.351	24	07:45:00
February	2.166	23	08:00:00
March	2.282	10	08:00:00
April	2.668	9	20:45:00
May	2.526	7	20:00:00
June	2.689	7	21:00:00
July	2.469	5	20:15:00
August	2.498	3	19:45:00
September	2.495	17	19:45:00
October	2.562	16	19:30:00
November	2.476	16	08:00:00
December	2.866	14	07:45:00

Extreme minima	Value	Day	Time
January	-0.012	12	13:30:00
February	-0.32	10	16:45:00
March	-0.388	9	15:30:00
April	-0.145	8	16:00:00
May	0.054	8	04:00:00
June	0.071	5	03:00:00
July	0.098	22	04:30:00
August	0.064	31	23:45:00
September	0	18	04:00:00
October	0.187	16	15:00:00
November	0.033	15	15:30:00
December	0.233	15	16:15:00

Mean sea level	Days	MSL
January	30	1.045
February	29	.872
March	27	.915
April	30	1.163
May	31	1.081
June	30	1.143
July	31	1.127
August	31	1.181
September	30	1.142
October	15	*
November	25	1.210
December	28	1.201
	Sum	Avg
	337	1.098

* No mean sea level value as more than 15 days of data missing

Whitby – Tide Gauge Information

Latitude 54° 29' 24.0" N **Longitude** 00° 36' 52.9" W **Grid Ref** NZ 8984 1140

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** In the Harbourmaster's office

Measuring Points Underneath the quay, next to the Harbour Office

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	NZ 8986 1141	E side of Pier Rd
Aux1	NZ 8992 1105	Bolt butt of Whitby Bridge
Aux2	NZ 8985 1134	Rivet quayside SE side of Pier Rd
Aux3	NZ 8983 1142	Rivet wall angle S side of road angle of lifeboat museum

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 3.00m below Ordnance Datum Newlyn (ODN)

TGZ = 9.105m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 011 Checked on progress of basement refurbishment

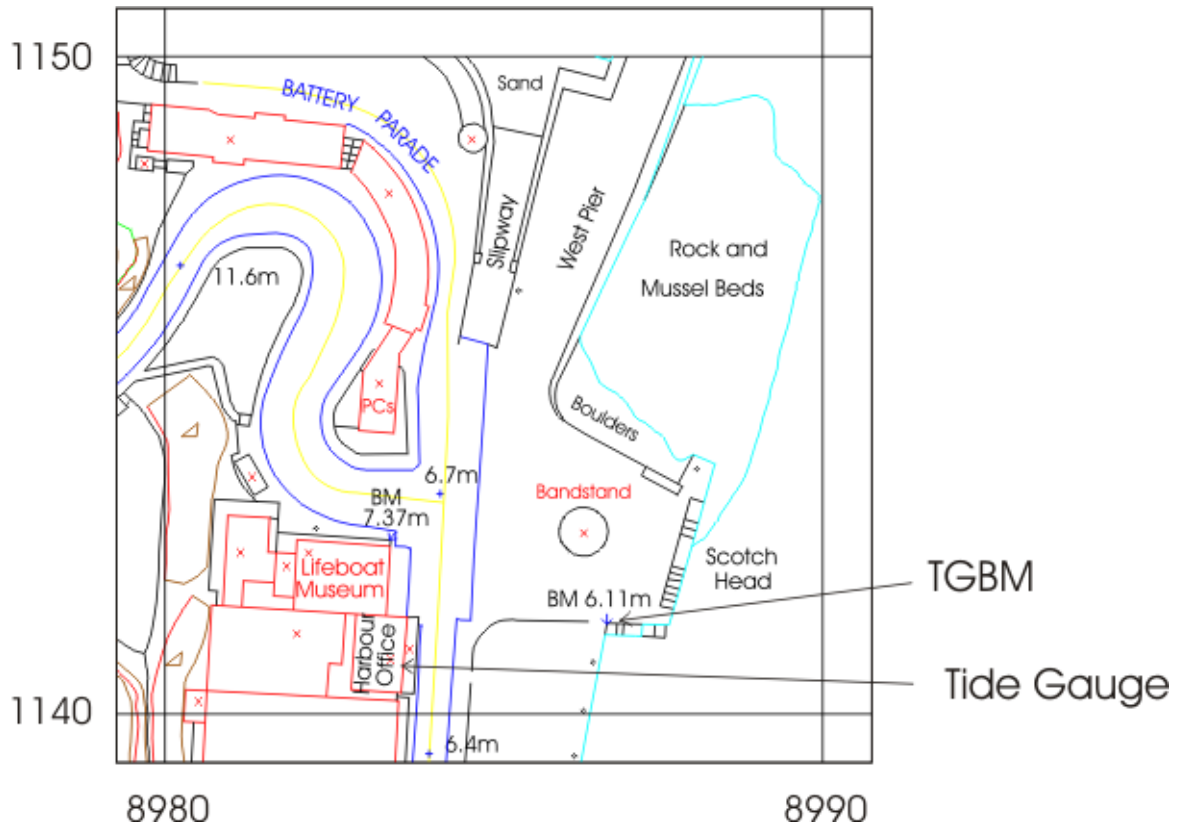
Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	121,122,205	001-009,024-026,038-043,068-072,096-099,121-123,317,348-350

Notes on Completeness/Quality

Both channels were at times recording ~40mm high, which was acceptable for monitoring extremes but was flagged as unacceptable for the purposes of long-term sea level monitoring.

Whitby – Map & Images of Site



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Whitby – Statistics

Surge maxima	Value	Day	Time
January	0.847	12	11:45:00
February	0.553	18	22:15:00
March	0.567	7	18:00:01
April	0.451	3	19:30:00
May	0.588	14	08:22:30
June	0.291	9	14:00:00
July	0.341	19	09:52:30
August	0.572	30	11:00:00
September	0.655	14	11:00:00
October	0.564	27	08:30:00
November	0.566	21	14:15:00
December	0.835	29	20:30:00

Surge minima	Value	Day	Time
January	-0.452	25	22:30:00
February	-0.556	10	14:00:00
March	-0.377	7	02:00:01
April	-0.186	5	11:00:00
May	-0.212	12	17:52:30
June	-0.105	23	03:15:00
July	-0.073	22	08:52:30
August	-0.298	27	19:30:00
September	-0.222	30	09:45:00
October	-0.168	12	23:45:00
November	-0.352	19	14:30:00
December	-0.519	23	10:45:00

Extreme maxima	Value	Day	Time
January	5.958	12	17:45:00
February	6.002	24	17:30:00
March	6.087	10	17:15:01
April	6.214	9	17:45:00
May	5.921	6	15:52:30
June	5.922	6	04:45:00
July	5.875	6	05:22:30
August	6.009	4	05:00:00
September	6.177	19	05:30:00
October	6.324	17	04:30:00
November	6.145	15	04:15:00
December	6.091	16	17:45:00

Extreme minima	Value	Day	Time
January	0.766	11	23:45:00
February	0.767	13	01:30:00
March	0.802	8	23:30:01
April	0.782	5	21:30:00
May	0.749	7	22:52:30
June	0.77	6	11:15:00
July	0.763	5	11:07:30
August	0.773	3	10:45:00
September	0.766	1	10:30:00
October	0.799	15	09:30:00
November	0.91	14	09:45:00
December	0.895	15	23:30:00

Mean sea level	Days	MSL
January	21	3.420
February	28	3.328
March	29	3.352
April	26	3.466
May	28	3.402
June	30	3.437
July	31	3.452
August	31	3.478
September	30	3.546
October	31	3.568
November	30	3.606
December	27	3.490
	Sum	Avg
	342	3.462

Wick – Tide Gauge Information

Latitude 58° 26' 27.5" N **Longitude** 03° 05' 10.7" W **Grid Ref** ND 3668 5081

Instrument Data acquisition system with two full-tide and a mid-tide bubbler gauge

Location **Tide Gauge Building** Northwest corner of Wick harbour, next to the ship repair slipway

Measuring Points Attached to an unused stilling well beneath the building

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark	Grid Ref	Description
TGBM	ND 3667 5081	New OSBM bolt quay E angle tide gauge building
Aux1	ND 3670 5084	Rivet base of wall 15.5M NE angle of building
Aux2	ND 3670 5083	NBM rivet base SE end of wall NE side of N pier
Aux3	ND 3705 5055	Wall base of steps SE side of pier

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 1.71m below Ordnance Datum (ODN)

TGZ = 5.084m below TGBM

Levelling No levelling was carried out in 2012

Site visits

Day 069 Installed S500 logger, migrated to Swantel telemetry system and decommissioned DATARING logger

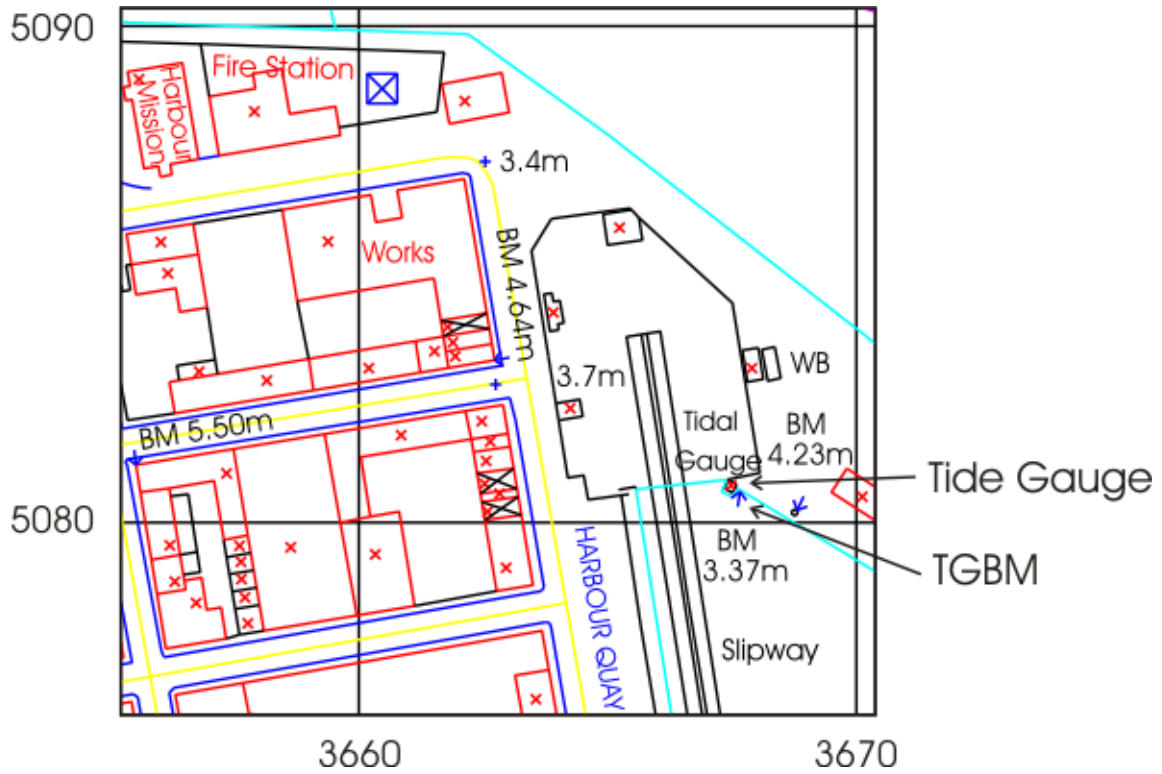
Day 121 Completed refurbishment and Swantel migration

Day 317 Installed PSTN line to replace GSM (mobile)

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	068	068,121

Wick – Map & Images of Site



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Wick – Statistics

Surge maxima	Value	Day	Time
January	0.492	18	12:30:00
February	0.291	23	22:15:00
March	0.423	7	06:30:00
April	0.359	10	03:30:00
May	0.546	14	02:45:00
June	0.309	29	15:30:00
July	0.29	22	20:30:00
August	0.429	28	05:30:00
September	0.485	14	08:00:00
October	0.417	31	18:00:00
November	0.431	10	05:00:00
December	0.794	29	16:00:00

Surge minima	Value	Day	Time
January	-0.389	13	17:00:00
February	-0.44	7	04:15:00
March	-0.305	2	08:45:00
April	-0.373	30	15:45:00
May	-0.377	1	03:30:00
June	-0.138	27	01:00:00
July	-0.206	6	12:00:00
August	-0.228	31	04:45:00
September	-0.36	26	06:15:00
October	-0.259	25	22:00:00
November	-0.395	27	19:00:00
December	-0.407	9	23:15:00

Extreme maxima	Value	Day	Time
January	3.681	25	12:30:00
February	3.827	22	11:30:00
March	3.857	9	11:45:00
April	3.98	9	13:00:00
May	3.658	8	00:15:00
June	3.697	7	00:45:00
July	3.684	23	01:45:00
August	3.729	4	00:15:00
September	3.909	16	23:30:00
October	3.927	16	23:45:00
November	3.909	16	00:15:00
December	4.204	15	00:15:00

Extreme minima	Value	Day	Time
January	0.374	13	19:45:00
February	0.066	10	18:45:00
March	0.068	10	18:45:00
April	0.174	7	17:30:00
May	0.254	5	16:15:00
June	0.354	5	05:15:00
July	0.196	6	06:45:00
August	0.287	31	04:45:00
September	0.411	19	06:45:00
October	0.412	15	04:15:00
November	0.574	15	05:30:00
December	0.561	11	02:30:00

Mean sea level	Days	MSL
January	31	2.098
February	29	1.945
March	27	1.951
April	30	1.958
May	31	1.922
June	30	1.984
July	31	1.995
August	31	2.066
September	30	2.142
October	31	2.132
November	30	2.219
December	31	2.161
	Sum	Avg
	362	2.048

Workington – Tide Gauge Information

Latitude 54° 39' 02.6" N **Longitude** 03° 34' 01.8" W **Grid Ref** NX 9898 2953

Instrument Data acquisition system with two full-tide bubbler gauges

Location **Tide Gauge Building** North side of the dock entrance

Measuring Points Behind fender piles on the north seaward side of the dock gates

Datum All data refer to Admiralty Chart Datum (ACD)

Benchmark **Grid Ref** **Description**

Aux1 NX 9917 2928 Building SW face 3.7M from S angle Workington Dock

Aux2 NX 9948 2967 NBM works building S side Rd N face NE angle

Benchmark Relationships

TGZ = Admiralty Chart Datum (ACD)

TGZ = 4.20m below Ordnance Datum Newlyn (ODN)

TGZ = 11.59m below Aux1

Levelling No levelling was carried out in 2012

Site visits

Day 060 Carried out general maintenance and upgraded telemetry outstation hardware

Day 338 Replaced compressor

Data quality

CI%	Sample Interval	Missing Data	Suspect Data
99%	15 minutes	031	022-023,051-052,228,338

Workington – Map & Images of Site



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Workington – Statistics

Surge maxima	Value	Day	Time
January	1.456	3	10:45:00
February	0.468	22	14:45:00
March	0.382	7	05:00:00
April	0.696	17	04:45:00
May	0.554	13	22:30:00
June	0.532	15	17:45:00
July	0.245	18	06:00:00
August	0.673	15	19:00:00
September	0.365	30	08:30:00
October	0.754	17	15:45:00
November	0.799	19	11:45:00
December	0.8	31	07:15:00

Surge minima	Value	Day	Time
January	-0.673	5	19:00:00
February	-0.71	14	00:30:00
March	-0.504	5	14:00:00
April	-1.096	29	15:30:00
May	-0.371	12	02:00:00
June	-0.245	4	00:15:00
July	-0.238	7	18:00:00
August	-0.425	30	12:45:00
September	-0.284	21	10:00:00
October	-0.592	27	01:00:00
November	-0.733	27	13:15:00
December	-0.715	7	17:00:00

Extreme maxima	Value	Day	Time
January	8.838	25	12:45:00
February	8.796	22	11:45:00
March	8.803	9	12:00:00
April	9.071	9	13:00:00
May	8.953	8	00:15:00
June	8.797	7	01:00:00
July	8.712	5	00:00:00
August	8.797	4	00:30:00
September	8.983	18	00:15:00
October	9.307	17	12:15:00
November	8.819	16	12:45:00
December	9.184	15	00:15:00

Extreme minima	Value	Day	Time
January	0.606	12	20:00:00
February	0.281	10	19:45:00
March	0.045	10	19:15:00
April	0.194	7	18:00:00
May	0.463	6	17:45:00
June	0.607	5	06:00:00
July	0.608	6	07:30:00
August	0.769	4	07:00:00
September	0.567	19	07:30:00
October	0.715	17	06:15:00
November	0.542	15	06:15:00
December	0.817	13	17:30:00

Mean sea level	Days	MSL
January	30	4.515
February	27	4.305
March	31	4.330
April	30	4.408
May	31	4.419
June	30	4.533
July	31	4.499
August	31	4.587
September	30	4.546
October	31	4.620
November	30	4.644
December	31	4.643
	Sum	Avg
	363	4.504