

# *National Tidal and Sea Level Facility*

*Annual Report for 2009 for the  
UK National Tide Gauge Network  
and Related Sea Level Science*

*Edited by Elizabeth Bradshaw  
and Paul McGarrigle*

## National Tidal and Sea Level Facility

### Annual Report for 2009 for the UK National Tide Gauge Network and Related Sea Level Science

Contributors to the Annual Report:

Kevin Horsburgh, POL	- Introduction
Les Bradley, POL	- Instrument documentation and site information
Dave Smith, POL	- Maps and site information
Steve Loch, BODC	- Calculating statistics
Peter Foden, POL	- South Atlantic Network Management
Simon Holgate, POL	- South Atlantic Network Management

Editors of the Annual report:

Elizabeth Bradshaw, BODC  
Paul McGarrigle, BODC

NTSLF Coordination Committee Members and Main Interests:

Colin Bell, POL Applications	- Tide Gauge Data Products
Juan Brown, BODC	- Director BODC
David Blackman, POL	- Tide Gauge Data Products
Libby Macleod, BODC	- Tide Gauge Data Sets
Richard Downer, BODC	- Web Development and Management
Kevin Horsburgh, POL	- Operational Tide-Surge Models and Chair of NTSLF
Peter Foden, POL	- South Atlantic Network Management
Andrew Wilmott, POL	- Director POL
Simon Holgate, PSMSL	- Permanent Service for Mean Sea Level (PSMSL) aspects
Philip Knight, POL	- Real-time systems development and management
Lesley Rickards, BODC	- Director of the PSMSL
Dave Smith, POL	- Leader Tide Gauge Inspectorate
Simon Williams, POL	- GPS and Absolute Gravity Networks

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

All maps are based on Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office ©Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. NERC 100017897 2009

## Foreword

Rising sea levels and climate change have profound implications for coastal protection and marine management. Managing the risk and developing effective forecasting systems demands the best understanding of the science behind sea level rise, storm surges and coastal flooding. Based at the Proudman Oceanographic Laboratory, with research partners in UK universities and the Met Office, 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. Our work is of strategic importance to government, local authorities, the public and the scientific community. The NTSLF also provides annual input to the UK Marine Climate Change Impacts Partnership. This report contains a summary of NTSLF activity for 2009.

NTSLF scientists and engineers are responsible for:

- Sea level monitoring around the UK and at key sites in the South Atlantic Ocean and the British Overseas Territories.
- Storm surge forecasting computer models.
- The calculation of extreme sea levels needed to design coastal defence options.
- Projections of extreme sea levels in future climate scenarios.
- Analysis of the tsunami risk to the UK.

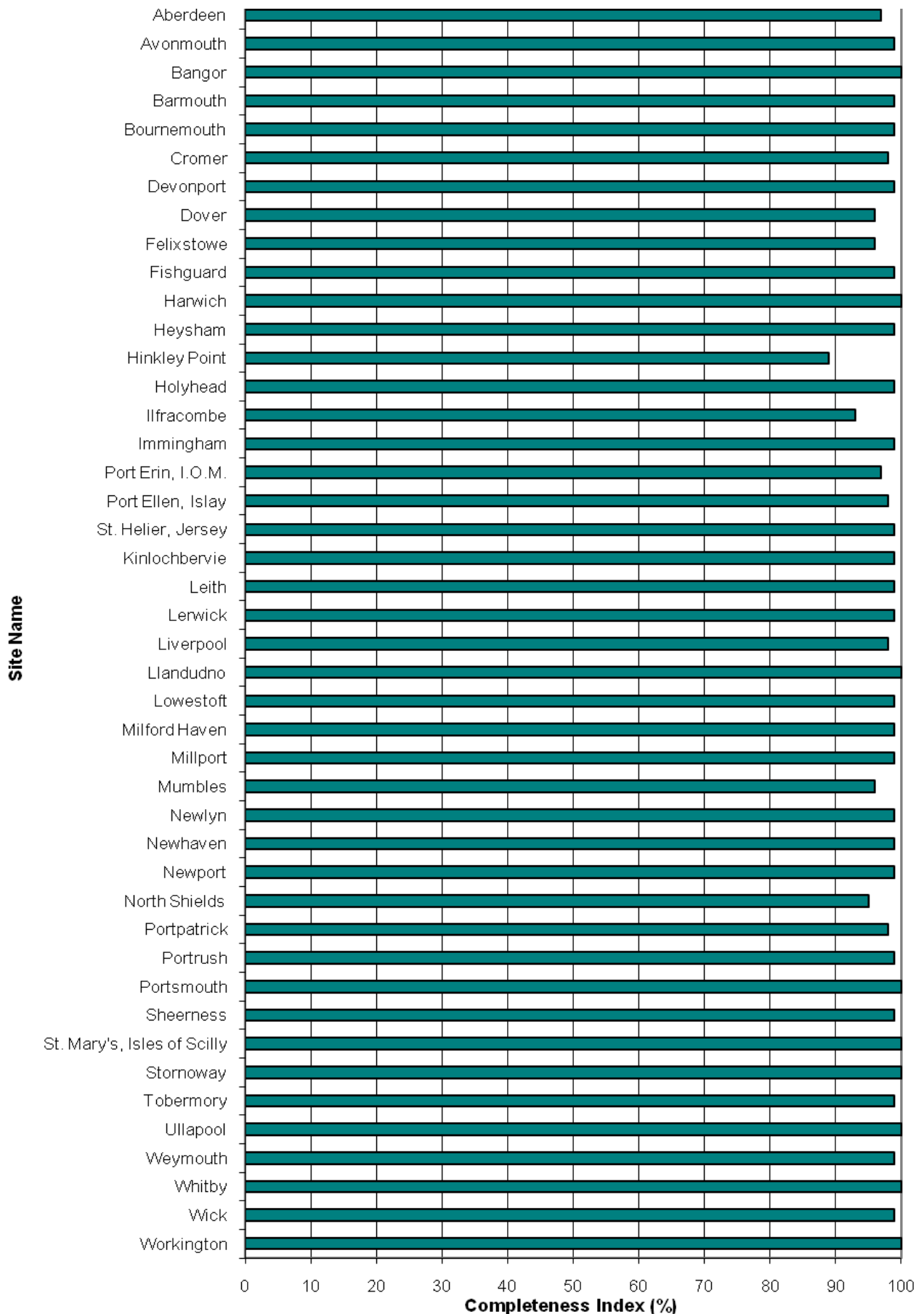
The NTSLF manages precision tide gauges at 44 sites around the UK. Sophisticated telemetry systems make these data available in real time for operational coastal flood warning. We are also responsible for monitoring sea level at sites in the south Atlantic as part of our contribution towards international climate change research.

Real-time data from all locations can be seen on our web pages at <http://www.pol.ac.uk/ntslf>. Tide gauge data - both unprocessed and quality-controlled - are available free of charge from the British Oceanographic Data Centre (BODC).

The UK National Tide Gauge network is owned and funded by the Environment Agency. We would like to thank all those who contribute scientifically towards, and make use of, the NTSLF.

Dr Kevin Horsburgh  
Head of NTSLF

**Histogram of Completeness Index (CI%) for UK Tide Gauge sites**



## Aberdeen Tide Gauge

Latitude: 57° 08' 38.6" N  
Longitude: 02° 04' 38.5" W  
Grid Reference: NJ 9525 0591

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 2.25m below Ordnance Datum Newlyn (ODN)  
TGZ = 6.318m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 050-051: TGI on site to replace modem.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
97	15 minutes	023,028-039	149-209,256-270,273- 274,279-281,284-285,294- 297,300-301,305-307,318- 319,321-343,345,348-349

Statistics:

Surge maxima	Value	Day	Time
January	1.016	18	13:00:00
February	0.239	26	07:00:00
March	0.509	8	22:00:00
April	0.366	7	23:30:00
May	0.629	7	19:30:00
June			
July	0.322	29	15:15:00
August	0.282	26	02:00:00
September	0.731	9	00:30:00
October	0.475	3	19:00:00
November	0.574	1	17:00:00
December	0.278	23	04:30:00

Surge minima	Value	Day	Time
January	-0.312	15	12:30:00
February	-0.269	13	12:00:00
March	-0.3	17	22:30:00
April	-0.198	20	20:00:00
May	-0.18	11	20:45:00
June			
July	-0.027	31	15:30:00
August	-0.12	13	20:30:00
September	-0.217	11	18:00:00
October	-0.296	17	05:30:00
November	-0.373	9	03:00:00
December	-0.337	31	10:00:00

Exteme Maxima	Value	Day	Time
January	5.074	12	13:45:00
February	4.59	10	13:45:00
March	4.735	12	14:00:00
April	4.507	10	13:30:00
May	4.514	26	14:15:00
June			
July	3.893	29	06:30:00
August	4.739	21	01:00:00
September	4.739	9	03:45:00
October	4.629	4	00:45:00
November	4.58	4	01:30:00
December	4.257	19	15:00:00

Extreme minima	Value	Day	Time
January	0.292	14	22:00:00
February	0.117	11	20:45:00
March	0.177	11	19:45:00
April	0.478	9	19:00:00
May	0.569	28	09:45:00
June			
July	1.552	29	12:30:00
August	0.19	22	08:15:00
September	0.273	19	07:15:00
October	0.294	17	06:15:00
November	0.864	8	23:45:00
December	0.594	31	19:00:00

Mean sea level	No days	MSL
January	23	2.666
February	20	2.516
March	31	2.545
April	30	2.49
May	28	2.553
June	0	
July	2	2.657
August	31	2.627
September	11	2.651
October	15	2.596
November	10	2.643
December	17	2.629
	Sum	Avg
	218	2.598

## Avonmouth Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 168: TGI on site to carry out general maintenance.  
Day 231 – 232: TGI on site to investigate a communications fault.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	133,224	None

Statistics:

Surge maxima	Value	Day	Time
January	1.565	17	19:30:00
February	0.776	10	14:15:00
March	1.109	3	18:45:00
April	1.156	8	01:45:00
May	0.878	16	17:45:00
June	0.774	28	17:00:00
July	0.934	19	12:00:00
August	0.88	21	14:15:00
September	1.008	3	00:00:00
October	0.615	24	10:15:00
November	1.568	14	12:45:00
December	1.015	6	08:30:00

Surge minima	Value	Day	Time
January	-0.625	5	18:30:00
February	-0.785	1	05:00:00
March	-0.682	22	10:15:00
April	-0.79	20	22:00:00
May	-0.634	12	07:45:00
June	-0.522	1	00:15:00
July	-0.428	9	02:45:00
August	-0.516	12	17:15:00
September	-0.857	10	17:00:00
October	-0.746	28	21:15:00
November	-0.651	28	22:00:00
December	-0.767	20	04:00:00

Exteme Maxima	Value	Day	Time
January	14.173	13	08:45:00
February	14.243	11	08:30:00
March	14.024	12	08:00:00
April	13.636	9	19:15:00
May	13.311	27	09:15:00
June	13.549	25	21:15:00
July	14.145	24	21:00:00
August	14.289	22	20:45:00
September	14.291	19	19:45:00
October	13.683	19	20:00:00
November	13.607	4	20:15:00
December	13.792	6	09:30:00

Extreme minima	Value	Day	Time
January	0.662	13	16:00:00
February	0.27	12	04:00:00
March	0.488	13	03:30:00
April	0.877	11	15:15:00
May	1.093	24	13:45:00
June	0.9	25	03:45:00
July	0.731	25	16:45:00
August	0.483	22	03:30:00
September	0.459	20	15:30:00
October	0.911	18	01:45:00
November	1.488	3	01:45:00
December	1.098	4	15:15:00

Mean sea level	No days	MSL
January	31	7.043
February	28	6.908
March	31	6.959
April	30	6.952
May	28	6.956
June	30	6.981
July	31	7.076
August	31	7.043
September	30	6.96
October	31	7.082
November	30	7.282
December	31	7.103
	Sum	Avg
	362	7.029



## Bangor Tide Gauge

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

### Benchmarks and Benchmark relationships:

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

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: There were no visits to site in 2009.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
100	15 minutes	None	049,077-078,086,107- 108,284,289- 290,301,311,320-323,342- 346

Statistics:

Surge maxima	Value	Day	Time
January	1.157	17	21:45:00
February	0.206	8	21:00:00
March	0.471	8	00:45:00
April	0.409	7	23:45:00
May	0.463	8	02:00:00
June	0.299	17	10:00:00
July	0.396	22	07:00:00
August	0.429	26	10:30:00
September	0.428	8	13:30:00
October	0.457	24	23:15:00
November	0.931	25	13:00:00
December	0.625	6	09:45:00

Surge minima	Value	Day	Time
January	-0.292	6	10:00:00
February	-0.281	19	19:30:00
March	-0.398	28	12:00:00
April	-0.263	22	01:30:00
May	-0.23	3	12:45:00
June	-0.213	1	07:15:00
July	-0.149	8	09:30:00
August	-0.193	13	13:30:00
September	-0.375	11	00:30:00
October	-0.361	16	09:45:00
November	-0.511	8	08:15:00
December	-0.361	18	11:15:00

Exteme Maxima	Value	Day	Time
January	4.1	15	14:00:00
February	3.811	12	13:00:00
March	3.717	26	11:00:00
April	3.786	9	10:45:00
May	3.663	8	10:15:00
June	3.728	27	02:00:00
July	3.875	27	02:30:00
August	3.903	25	02:15:00
September	3.86	22	01:00:00
October	3.831	19	23:45:00
November	3.94	6	13:00:00
December	4.348	6	13:45:00

Extreme minima	Value	Day	Time
January	0.242	13	18:45:00
February	0.067	11	18:15:00
March	0.193	28	18:00:00
April	0.349	28	06:45:00
May	0.19	29	08:30:00
June	0.189	25	06:30:00
July	0.1	25	07:00:00
August	0.175	22	05:45:00
September	0.132	20	05:30:00
October	0.167	16	03:00:00
November	0.377	8	21:00:00
December	0.487	17	17:45:00

Mean sea level	No days	MSL
January	31	2.157
February	26	1.956
March	27	1.988
April	28	1.974
May	31	1.988
June	30	1.979
July	31	2.078
August	31	2.099
September	30	1.999
October	31	2.104
November	22	2.251
December	25	2.191
	Sum	Avg
	343	2.064

## Barmouth Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)

TGZ = 2.44m below ODN

TGZ = 10.363m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 076:	TGI on site to carry out general maintenance and purge system.
	Day 189:	TGI on site to carry out general maintenance.
	Day 281:	TGI on site to carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	076,189	024-077,150-218,247-265

Statistics:

Surge maxima	Value	Day	Time
January	1.257	17	18:15:00
February	0.081	3	04:30:00
March	0.485	26	09:15:00
April	0.589	8	00:15:00
May	0.57	16	15:15:00
June			
July	0.335	28	15:45:00
August	0.548	20	11:00:00
September	0.522	3	00:15:00
October	0.728	24	16:45:00
November	1.105	24	19:45:00
December	0.685	7	08:15:00

Surge minima	Value	Day	Time
January	-0.403	6	03:30:00
February	-0.258	2	02:00:00
March	-0.407	28	12:15:00
April	-0.311	21	21:00:00
May	-0.337	3	13:00:00
June			
July	0.037	26	22:30:00
August	-0.189	13	06:30:00
September	-0.29	26	09:00:00
October	-0.417	16	02:30:00
November	-0.572	8	13:00:00
December	-0.578	18	10:15:00

Exteme Maxima	Value	Day	Time
January	5.561	15	11:00:00
February	3.66	1	00:45:00
March	5.421	27	08:30:00
April	5.334	9	20:15:00
May	5.149	8	07:30:00
June			
July	5.22	26	23:15:00
August	5.706	21	21:00:00
September	5.507	19	20:30:00
October	5.47	19	20:45:00
November	5.816	18	08:30:00
December	5.65	6	10:45:00

Extreme minima	Value	Day	Time
January	0.78	14	05:45:00
February	1.414	1	17:30:00
March	0.695	28	17:00:00
April	0.764	26	04:15:00
May	0.808	29	07:15:00
June			
July	0.986	26	18:30:00
August	0.808	22	17:15:00
September	0.711	20	17:00:00
October	0.671	17	02:45:00
November	0.975	30	01:15:00
December	0.843	18	16:45:00

Mean sea level	No days	MSL
January	22	2.797
February	0	
March	13	2.6
April	30	2.65
May	29	2.684
June	0	
July	0	
August	25	2.776
September	10	2.688
October	31	2.765
November	30	3
December	31	2.821
	Sum	Avg
	221	2.753

## Bournemouth Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 1.40m below ODN  
TGZ = 5.96m below Aux1

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 90:	TGI on site to carry out general maintenance.
	Day 300:	TGI on site to replace the compressor and carry out general maintenance.
	Day 351:	TGI on site to install a new counter card.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	343-349	None

Statistics:

Surge maxima	Value	Day	Time
January	0.733	19	05:45:00
February	0.603	9	22:15:00
March	0.574	3	20:00:00
April	0.361	8	02:00:00
May	0.293	17	12:15:00
June	0.266	6	23:30:00
July	0.274	15	01:15:00
August	0.235	26	07:30:00
September	0.338	2	18:30:00
October	0.359	7	13:15:00
November	0.673	14	11:30:00
December	0.533	6	05:15:00

Surge minima	Value	Day	Time
January	-0.319	6	01:30:00
February	-0.27	1	05:45:00
March	-0.306	18	07:45:00
April	-0.243	21	21:00:00
May	-0.322	12	06:00:00
June	-0.184	1	11:00:00
July	-0.224	17	21:00:00
August	-0.21	28	19:00:00
September	-0.357	10	13:30:00
October	-0.335	16	02:00:00
November	-0.333	8	20:45:00
December	-0.396	18	17:00:00

Exteme Maxima	Value	Day	Time
January	2.686	19	06:30:00
February	2.732	9	21:30:00
March	2.401	27	09:00:00
April	2.389	9	21:00:00
May	2.303	25	21:00:00
June	2.427	25	22:45:00
July	2.516	23	21:45:00
August	2.521	22	22:15:00
September	2.446	19	21:00:00
October	2.548	20	09:15:00
November	2.63	4	09:30:00
December	2.487	5	10:00:00

Extreme minima	Value	Day	Time
January	0.238	13	17:30:00
February	0.056	11	17:00:00
March	0.098	11	16:00:00
April	0.371	8	14:45:00
May	0.303	27	05:15:00
June	0.207	25	05:15:00
July	0.133	25	05:45:00
August	0.08	22	04:30:00
September	0.115	20	04:15:00
October	0.247	18	03:00:00
November	0.615	8	19:45:00
December	0.339	18	17:00:00

Mean sea level	No days	MSL
January	31	1.631
February	28	1.561
March	31	1.542
April	30	1.563
May	31	1.523
June	30	1.593
July	31	1.632
August	31	1.598
September	30	1.546
October	31	1.643
November	30	1.795
December	22	1.788
	Sum	Avg
	356	1.618

## Cromer Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 2.75m below Ordnance Datum Newlyn  
TGZ = 10.117m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 239: TGI on site to replace the compressor and carry out general maintenance.  
Day 329: TGI on site to carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
98	15 minutes	182-187,238-239,266,348	031-034,041-043,082-083,087-088,104-109,119-122,125-126,154-155,158-160,191,197-202,239-290,335,351-352,354,364-365

Statistics:

Surge maxima	Value	Day	Time
January	1.084	18	19:30:00
February	0.447	10	04:00:00
March	0.756	23	21:30:00
April	0.307	12	05:15:00
May	0.44	26	17:00:00
June	0.381	18	10:45:00
July	0.434	10	02:45:00
August	0.279	24	16:30:00
September			
October	0.609	16	12:30:00
November	0.612	30	01:30:00
December	0.542	27	23:00:00

Surge minima	Value	Day	Time
January	-0.983	22	12:00:00
February	-0.414	1	06:45:00
March	-0.635	3	23:15:00
April	-0.328	23	01:45:00
May	-0.39	7	02:00:00
June	-0.311	17	08:15:00
July	-0.294	26	18:30:00
August	-0.366	23	17:30:00
September			
October	-0.647	25	06:30:00
November	-0.579	25	01:45:00
December	-0.578	2	04:45:00

Exteme Maxima	Value	Day	Time
January	5.681	12	19:15:00
February	5.499	11	19:45:00
March	5.559	12	19:15:00
April	5.229	10	19:00:00
May	5.171	26	19:45:00
June	5.225	26	08:45:00
July	5.509	25	08:30:00
August	5.521	22	07:15:00
September			
October	5.308	19	06:30:00
November	5.229	4	07:00:00
December	5.162	3	19:00:00

Extreme minima	Value	Day	Time
January	0.275	15	04:00:00
February	0.42	11	02:15:00
March	0.2	12	01:45:00
April	0.495	10	01:15:00
May	0.553	27	15:15:00
June	0.534	25	15:00:00
July	0.398	24	15:15:00
August	0.256	23	15:30:00
September			
October	0.519	18	13:00:00
November	0.669	3	13:15:00
December	0.67	6	03:45:00

Mean sea level	No days	MSL
January	30	2.926
February	20	2.942
March	25	2.902
April	20	2.869
May	25	2.907
June	22	2.931
July	16	2.993
August	24	2.963
September	0	
October	13	2.876
November	28	2.982
December	22	3.035
	Sum	Avg
	245	2.939



## Devonport Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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	FI Br 11818 bldg W face NW angle

TGZ = Admiralty Chart Datum (ACD)

TGZ = 3.22m below ODN

TGZ = 7.631m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 189: TGI on site to replace the compressor and carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	189	001-029,048-049,056-058,065-066,069,078-079,084-119,133-145,153-164,166-168,175-176,182-183

Statistics:

Surge maxima	Value	Day	Time
January	0.193	30	22:45:00
February	0.548	5	08:30:00
March	0.392	3	17:45:00
April	0.162	30	05:15:00
May	0.21	12	00:30:00
June	0.221	28	15:15:00
July	0.322	14	22:00:00
August	0.279	26	09:00:00
September	0.259	2	16:00:00
October	0.336	20	10:30:00
November	0.788	14	09:15:00
December	0.589	6	03:30:00

Surge minima	Value	Day	Time
January	-0.009	29	14:15:00
February	-0.253	20	19:45:00
March	-0.285	22	20:30:00
April	-0.05	30	22:45:00
May	-0.22	3	12:15:00
June	-0.155	1	00:00:00
July	-0.24	17	23:15:00
August	-0.252	28	21:15:00
September	-0.315	10	15:15:00
October	-0.298	16	03:00:00
November	-0.308	8	21:30:00
December	-0.362	18	12:45:00

Exteme Maxima	Value	Day	Time
January	5.917	13	07:15:00
February	5.902	11	07:00:00
March	5.707	12	06:30:00
April	5.397	29	20:45:00
May	5.548	25	18:00:00
June	5.78	25	19:45:00
July	5.915	23	18:45:00
August	5.952	22	19:15:00
September	5.827	19	18:00:00
October	5.909	20	06:45:00
November	5.835	16	05:00:00
December	5.838	6	08:00:00

Extreme minima	Value	Day	Time
January	0.732	13	01:00:00
February	0.349	11	13:15:00
March	0.301	12	13:00:00
April	1.045	29	02:15:00
May	0.693	27	01:30:00
June	0.708	24	00:15:00
July	0.383	25	02:00:00
August	0.308	22	01:00:00
September	0.321	20	00:30:00
October	0.581	17	23:30:00
November	1.091	2	23:30:00
December	0.945	4	13:00:00

Mean sea level	No days	MSL
January	2	3.493
February	22	3.398
March	15	3.301
April	1	3.432
May	16	3.307
June	10	3.352
July	26	3.425
August	31	3.384
September	30	3.33
October	31	3.454
November	30	3.602
December	31	3.556
	Sum	Avg
	245	3.42

## Dover Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	Description
TGBM	TR 3193 4074	FI 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

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 179: TGI on site to replace the compressor and carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
96	15 minutes	070,075,112,175- 181,203,266,363-365	None

Statistics:

Surge maxima	Value	Day	Time
January	1.089	23	06:30:00
February	0.858	10	08:45:00
March	0.567	24	05:15:00
April	0.257	27	22:30:00
May	0.281	26	22:30:00
June	0.348	9	22:30:00
July	0.418	8	22:14:59
August	0.434	29	03:15:00
September	0.569	9	13:45:00
October	0.664	4	10:30:00
November	0.726	23	12:00:00
December	0.533	25	02:00:00

Surge minima	Value	Day	Time
January	-0.698	22	08:00:00
February	-0.426	1	11:00:00
March	-0.691	4	03:00:00
April	-0.339	23	06:45:00
May	-0.401	12	10:30:00
June	-0.238	17	05:15:00
July	-0.248	15	15:59:59
August	-0.318	15	04:30:00
September	-0.416	17	07:15:00
October	-0.391	15	05:30:00
November	-0.843	14	20:30:00
December	-0.389	2	10:15:00

Exteme Maxima	Value	Day	Time
January	7.165	14	00:45:00
February	7.234	10	23:45:00
March	7.178	13	00:00:00
April	6.902	10	23:30:00
May	6.76	27	00:30:00
June	6.561	23	23:30:00
July	7.115	25	13:15:00
August	7.144	22	12:15:00
September	7.315	20	11:45:00
October	7.249	4	10:45:00
November	6.951	4	11:30:00
December	6.838	3	23:30:00

Extreme minima	Value	Day	Time
January	0.561	12	06:45:00
February	0.501	11	07:30:00
March	0.322	12	07:00:00
April	0.663	10	06:45:00
May	0.765	27	20:15:00
June	0.779	23	18:30:00
July	0.557	25	21:00:00
August	0.439	22	20:00:00
September	0.545	19	18:45:00
October	0.634	18	18:15:00
November	0.907	3	18:30:00
December	0.993	5	07:45:00

Mean sea level	No days	MSL
January	31	3.726
February	28	3.734
March	31	3.721
April	30	3.697
May	31	3.686
June	22	3.762
July	30	3.801
August	31	3.767
September	30	3.773
October	31	3.809
November	30	3.907
December	28	3.874
	Sum	Avg
	353	3.771

## Felixstowe Tide Gauge

Latitude: 51° 57' 27.7" N  
 Longitude: 01° 20' 47.6" E  
 Grid Reference: TM 3003 3409

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	Description
TGBM	TM 3001 3414	Bolt on the SE side of prom NE face of arcade
Aux1 NW face.	TM 2956 3393	Flush Bracket 2071 on No. 25 Langer Road W angle
Aux3	TM 3003 3409	Rivet outside TG building

TGZ = Admiralty Chart Datum (ACD)  
 TGZ = 1.95m below ODN  
 TGZ = 5.69m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 70:	TGI on site to install temporary replacement battery.
	Day 82:	Diving team on site, but no diving due to weather; replaced temporary battery.
	Day 180:	TGI on site to survey for the repair of underwater measuring system.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
96	15 minutes	050,056-070	002-006,008,011-023,025-026,029-036,040-042,044,045,077-079,083-084,085-089,091-093,098,100,105-109,117,121,127-139,147-158,175-176,190-192,196,211-213,226-227,231-233,235,238-240,245-246,249-264,274-279,282-283,285-287,289-298,301,303-305,307,310-312,315-330,332-337,339-365

Statistics:

Surge maxima	Value	Day	Time
January	0.774	18	20:00:00
February	0.328	22	17:30:00
March	0.703	24	01:45:00
April	0.284	12	08:30:00
May	0.362	26	21:00:00
June	0.355	18	09:45:00
July	0.421	8	20:45:00
August	0.504	29	02:00:00
September	1.033	9	09:00:00
October	0.923	4	06:30:00
November	0.466	27	18:15:00
December	0.593	28	04:45:00

Surge minima	Value	Day	Time
January	-0.418	10	19:00:00
February	-0.279	24	06:30:00
March	-0.373	25	03:00:00
April	-0.34	21	07:15:00
May	-0.33	4	22:15:00
June	-0.334	17	14:15:00
July	-0.27	19	22:15:00
August	-0.348	31	03:30:00
September	-0.44	8	20:45:00
October	-0.514	25	11:00:00
November	-0.388	3	19:30:00
December	-0.197	9	07:45:00

Exteme Maxima	Value	Day	Time
January	4.246	13	13:15:00
February	4.072	12	01:15:00
March	4.2	13	00:45:00
April	4.065	11	00:15:00
May	4.082	27	01:00:00
June	4.12	26	01:45:00
July	4.2	25	01:30:00
August	4.2	22	00:15:00
September	4.304	9	14:15:00
October	4.304	7	13:00:00
November	4.24	4	12:00:00
December	4.069	4	12:30:00

Extreme minima	Value	Day	Time
January	0.255	14	07:30:00
February	0.062	11	06:30:00
March	-0.047	12	06:00:00
April	0.28	8	04:30:00
May	0.189	7	04:00:00
June	0.209	25	19:30:00
July	0.091	26	20:45:00
August	0.043	23	19:45:00
September	0.201	8	19:30:00
October	0.244	18	17:15:00
November	0.309	3	17:45:00
December	0.473	9	10:30:00

Mean sea level	No days	MSL
January	0	
February	12	2.063
March	9	2.045
April	13	2.002
May	11	2.029
June	20	2.09
July	21	2.119
August	15	2.12
September	12	2.196
October	1	2.26
November	2	2.206
December	0	
	Sum	Avg
	116	2.113

## Fishguard Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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	FI Br 11518 blding SW side railway bridge SE Face

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 2.44m below ODN  
TGZ = 7.88m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 189: TGI on site to replace the compressor and carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	161, 189	085-218

Statistics:

Surge maxima	Value	Day	Time
January	0.743	17	19:15:00
February	0.403	3	22:30:00
March	0.41	3	16:15:00
April			
May			
June			
July			
August	0.389	26	07:30:00
September	0.254	2	14:30:00
October	0.323	21	03:30:00
November	0.766	14	09:45:00
December	0.452	6	04:00:00

Surge minima	Value	Day	Time
January	-0.28	6	03:15:00
February	-0.233	19	15:45:00
March	-0.279	23	23:30:00
April			
May			
June			
July			
August	-0.238	29	01:15:00
September	-0.365	10	22:30:00
October	-0.307	16	02:15:00
November	-0.41	8	11:45:00
December	-0.354	18	07:45:00

Exteme Maxima	Value	Day	Time
January	5.243	13	08:30:00
February	5.238	11	08:15:00
March	5.093	12	08:00:00
April			
May			
June			
July			
August	5.314	22	20:45:00
September	5.2	19	19:30:00
October	5.193	19	19:45:00
November	5.091	18	07:45:00
December	5.245	6	09:45:00

Extreme minima	Value	Day	Time
January	0.591	13	15:30:00
February	0.382	11	15:15:00
March	0.407	12	14:45:00
April			
May			
June			
July			
August	0.365	22	02:45:00
September	0.36	20	02:15:00
October	0.628	18	01:15:00
November	1.01	3	01:15:00
December	0.93	4	02:30:00

Mean sea level	No days	MSL
January	31	2.792
February	28	2.635
March	24	2.616
April	0	
May	0	
June	0	
July	0	
August	25	2.708
September	30	2.627
October	31	2.769
November	30	2.914
December	31	2.85
	Sum	Avg
	230	2.739



## Harwich Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 2.02m below ODN  
TGZ = 6.17m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 081:	TGI on site to clear blockages from channels 1 & 2; mid tide also checked.
	Day 180:	TGI on site to carry out general maintenance and purge system.
	Day 201:	TGI & divers on site - for removal and installation of new full tide pressure points.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
100	15 minutes	None	001-081,092-094,120-121,126,128-129,131-187,200-201

Statistics:

Surge maxima	Value	Day	Time
January			
February			
March	0.778	24	06:15:00
April	0.203	9	09:15:00
May	0.286	7	17:45:00
June			
July	0.503	10	08:00:00
August	0.45	29	01:45:00
September	0.933	9	09:15:00
October	0.923	4	06:30:00
November	0.777	23	14:00:00
December	0.609	28	05:15:00

Surge minima	Value	Day	Time
January			
February			
March	-0.429	26	13:00:00
April	-0.373	8	12:00:00
May	-0.351	4	19:15:00
June			
July	-0.411	26	14:15:00
August	-0.482	23	13:00:00
September	-0.52	8	21:00:00
October	-0.627	25	11:15:00
November	-0.822	18	13:00:00
December	-0.583	6	15:30:00

Exteme Maxima	Value	Day	Time
January			
February			
March	4.26	29	01:15:00
April	4.256	28	01:15:00
May	4.07	10	12:30:00
June			
July	4.395	25	01:30:00
August	4.377	22	00:30:00
September	4.401	9	14:15:00
October	4.531	4	11:30:00
November	4.405	4	12:00:00
December	4.286	7	15:00:00

Extreme minima	Value	Day	Time
January			
February			
March	0.234	25	04:45:00
April	0.229	10	05:45:00
May	0.251	7	04:15:00
June			
July	0.061	26	21:00:00
August	0.014	23	19:45:00
September	0.159	19	17:45:00
October	0.187	17	16:30:00
November	0.281	3	17:45:00
December	0.329	6	08:15:00

Mean sea level	No days	MSL
January	0	
February	0	
March	8	2.173
April	26	2.104
May	6	2.097
June	0	
July	25	2.203
August	31	2.174
September	30	2.213
October	31	2.209
November	30	2.232
December	31	2.253
	Sum	Avg
	218	2.184

## Heysham Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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.

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 4.90m below Ordnance Datum Newlyn (ODN)  
TGZ = 12.098m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 113: TGI on site to clear blockages and general maintenance.  
Day 223: TGI on site to carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	113	001,018-035,049-060,077-083,086-113,194-206,223,229-234,275-278,297-298,305-365

Statistics:

Surge maxima	Value	Day	Time
January	1.268	17	22:30:00
February	0.392	4	02:15:00
March	1.328	3	21:15:00
April	0.366	27	05:30:00
May	0.945	8	03:15:00
June	0.569	17	15:00:00
July	0.557	29	00:45:00
August	0.678	27	22:30:00
September	0.574	3	05:15:00
October	0.668	3	07:45:00
November	1.036	1	13:30:00
December			

Surge minima	Value	Day	Time
January	-0.396	6	06:30:00
February	-0.348	18	07:30:00
March	-0.327	24	00:30:00
April	-0.241	25	05:45:00
May	-0.285	11	16:45:00
June	-0.222	1	08:00:00
July	-0.128	25	03:00:00
August	-0.182	13	10:45:00
September	-0.43	15	23:00:00
October	-0.436	12	00:00:00
November	-0.139	1	01:30:00
December			

Exteme Maxima	Value	Day	Time
January	10.239	13	12:45:00
February	10.282	12	13:00:00
March	10.227	12	12:00:00
April	9.834	27	12:30:00
May	9.732	27	13:00:00
June	9.88	26	01:15:00
July	10.162	25	01:15:00
August	10.435	23	00:30:00
September	10.287	19	23:30:00
October	9.976	18	23:15:00
November	8.978	1	10:00:00
December			

Extreme minima	Value	Day	Time
January	0.701	13	19:45:00
February	0.317	11	19:30:00
March	0.598	12	19:00:00
April	0.984	26	06:15:00
May	1.136	25	18:00:00
June	0.745	25	07:15:00
July	0.486	25	08:00:00
August	0.781	23	07:30:00
September	0.455	20	06:30:00
October	0.845	17	04:45:00
November	1.798	1	04:00:00
December			

Mean sea level	No days	MSL
January	15	5.244
February	12	5.102
March	14	5.205
April	7	5.125
May	31	5.158
June	30	5.142
July	18	5.284
August	24	5.28
September	30	5.164
October	23	5.223
November	0	
December	0	
	Sum	Avg
	204	5.193

## Hinkley Point Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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.

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day	Description
	Day 169:	TGI on site to test interface to EA outstation.
	Day 265:	TGI on site to install new datalogger.
	Day 274:	TGI on site to repair a datalogger fault.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
89	15 minutes	001,018,021-023,032,048,103,108,111,121,126-128,144,152,166,182,203,213,234,239,244-245,251,259,264-281	245-251

Statistics:

Surge maxima	Value	Day	Time
January	1.108	17	19:14:59
February	0.458	5	09:59:59
March	0.793	3	18:00:00
April	0.742	8	00:45:00
May	0.592	16	16:29:59
June	0.344	26	04:59:59
July	0.539	22	02:29:59
August	0.518	20	13:44:59
September	0.326	1	13:00:00
October	0.464	24	09:45:00
November	1.212	14	11:30:00
December	0.695	6	07:30:00

Surge minima	Value	Day	Time
January	-0.466	6	02:45:00
February	-0.494	18	14:44:59
March	-0.604	22	09:00:00
April	-0.487	20	20:14:59
May	-0.393	12	06:14:59
June	-0.34	22	07:14:59
July	-0.298	18	15:44:59
August	-0.316	15	13:59:59
September	-0.476	10	15:29:59
October	-0.387	28	19:30:00
November	-0.395	9	01:45:00
December	-0.498	19	02:00:00

Exteme Maxima	Value	Day	Time
January	12.542	13	08:15:00
February	12.592	11	07:59:59
March	12.42	12	07:30:00
April	12.125	9	18:44:59
May	11.804	26	19:59:59
June	12.071	25	20:44:59
July	12.52	24	20:29:59
August	12.674	22	20:14:59
September	12.633	19	19:14:59
October	12.191	19	19:15:00
November	12.127	4	19:30:00
December	12.133	6	09:00:00

Extreme minima	Value	Day	Time
January	0.607	14	03:00:00
February	0.132	12	02:44:59
March	0.225	13	02:15:00
April	0.724	26	13:29:59
May	0.943	25	13:14:59
June	0.824	25	14:44:59
July	0.496	25	02:59:59
August	0.152	22	14:14:59
September	0.205	20	13:59:59
October	0.624	18	12:45:00
November	1.274	3	00:45:00
December	1.072	4	14:00:00

Mean sea level	No days	MSL
January	26	6.242
February	28	6.146
March	31	6.17
April	30	6.179
May	26	6.166
June	30	6.21
July	31	6.286
August	31	6.252
September	12	6.099
October	23	6.292
November	30	6.505
December	31	6.364
	Sum	Avg
	329	6.243

## Holyhead Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	Description
TGBM	SH 2553 8287	Bolt on concrete foundation, N side of T G building.
Aux1	SH 2556 8289	Cut mark lighthouse.
Aux3	SH 2506 8292	Bolt Salt Island bridge.

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:

Day 083:	TGI on site to survey damage to system.
Day 153:	TGI on site to carry out general maintenance and meet with contractors.
Day 176:	TGI on site to remove sensors prior to stilling well repair.
Day 266:	TGI on site to carry out general maintenance and survey of stilling wells.
Day 329:	TGI on site to carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	147-148	159-218

Statistics:

Surge maxima	Value	Day	Time
January	0.892	17	23:45:00
February	0.363	3	23:30:00
March	0.501	3	19:00:00
April	0.444	8	00:00:00
May	0.44	16	10:45:00
June	0.133	8	07:15:00
July			
August	0.462	26	07:45:00
September	0.319	8	13:00:00
October	0.415	24	15:30:00
November	0.868	25	12:15:00
December	0.578	7	08:00:00

Surge minima	Value	Day	Time
January	-0.3	6	06:45:00
February	-0.288	21	05:30:00
March	-0.399	28	12:30:00
April	-0.25	22	00:30:00
May	-0.274	3	12:45:00
June	-0.199	1	06:15:00
July			
August	-0.199	28	20:30:00
September	-0.355	10	22:00:00
October	-0.3	16	08:00:00
November	-0.476	8	09:00:00
December	-0.407	18	07:30:00

Exteme Maxima	Value	Day	Time
January	6.056	15	13:15:00
February	6.023	11	11:30:00
March	5.908	12	11:00:00
April	5.905	9	10:00:00
May	5.631	25	23:00:00
June	5.265	7	22:15:00
July			
August	6.186	21	23:00:00
September	6.032	19	22:30:00
October	6.036	19	23:00:00
November	6.008	19	11:45:00
December	6.227	6	13:00:00

Extreme minima	Value	Day	Time
January	0.323	13	18:00:00
February	0.072	11	17:30:00
March	0.203	12	17:15:00
April	0.539	26	04:30:00
May	0.579	28	07:00:00
June	1.193	1	11:00:00
July			
August	0.159	22	05:15:00
September	0.17	20	04:45:00
October	0.458	17	03:00:00
November	0.995	5	17:45:00
December	0.777	3	16:45:00

Mean sea level	No days	MSL
January	31	3.36
February	28	3.158
March	31	3.165
April	30	3.197
May	28	3.199
June	7	3.169
July	0	
August	25	3.315
September	30	3.223
October	31	3.361
November	30	3.53
December	31	3.419
	Sum	Avg
	302	3.281



## Ifracombe Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	Description
TGBM	SS 5263 4791	OSBM Bolt on concrete pier, S.angle of T G hut.
Aux1	SS 5245 4782	Pier Hotel, The Quay
Aux2	SS 5251 4789	St Nicholas chapel N face 6.1M from NW angle

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 179: TGI on site to carry out general maintenance.  
Day 189: TGI on site to replace a modem.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
93	15 minutes	147-151,154-155,182-196,210,315-319	012-013,025-026,032,041,132,308-309,351-352,363-365

Statistics:

Surge maxima	Value	Day	Time
January	0.955	17	18:15:00
February	0.453	5	10:00:00
March	0.638	3	16:30:00
April	0.56	7	23:45:00
May	0.533	16	06:45:00
June	0.305	26	04:00:00
July	0.491	22	01:45:00
August	0.444	26	05:15:00
September	0.439	2	21:15:00
October	0.422	6	16:15:00
November	0.699	24	21:15:00
December	0.605	6	06:30:00

Surge minima	Value	Day	Time
January	-0.316	6	02:30:00
February	-0.266	18	02:30:00
March	-0.312	22	10:00:00
April	-0.29	21	20:15:00
May	-0.262	5	03:15:00
June	-0.219	22	06:15:00
July	-0.206	17	13:30:00
August	-0.202	29	01:30:00
September	-0.271	12	14:00:00
October	-0.305	16	02:15:00
November	-0.31	8	11:30:00
December	-0.317	18	23:30:00

Exteme Maxima	Value	Day	Time
January	9.795	13	07:15:00
February	9.841	11	07:00:00
March	9.665	12	06:45:00
April	9.542	9	18:00:00
May	9.185	25	18:30:00
June	9.462	25	20:00:00
July	9.819	23	19:00:00
August	9.953	22	19:30:00
September	9.874	19	18:15:00
October	9.598	19	18:30:00
November	9.383	3	18:15:00
December	9.512	6	08:15:00

Extreme minima	Value	Day	Time
January	0.652	13	13:30:00
February	0.255	12	01:30:00
March	0.298	13	01:00:00
April	0.814	26	12:30:00
May	0.926	27	01:15:00
June	0.851	25	01:15:00
July	0.503	25	01:45:00
August	0.275	22	13:00:00
September	0.292	20	12:45:00
October	0.687	18	11:30:00
November	1.219	2	23:30:00
December	1.069	4	00:30:00

Mean sea level	No days	MSL
January	26	5.063
February	25	4.903
March	31	4.895
April	30	4.95
May	23	4.952
June	25	4.987
July	16	5.026
August	31	5.006
September	30	4.931
October	31	5.061
November	21	5.23
December	26	5.155
	Sum	Avg
	315	5.013

## Immingham Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 3.90m below ODN  
TGZ = 9.131m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 092:	TGI on site to update memory card.
	Day 231 – 232:	TGI on site to meet BT for site survey.
	Day 238:	TGI on site to fix problem with mid tide and adjust datum.
	Day 294:	TGI on site to replace modem.
	Day 314:	TGI on site to supervise connection of BT line.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	092,186-187,231-232	232-301,303-314

Statistics:

Surge maxima	Value	Day	Time
January	1.27	18	18:30:00
February	0.506	10	04:15:00
March	0.618	23	23:15:00
April	0.298	9	03:15:00
May	0.417	7	22:45:00
June	0.308	18	08:45:00
July	0.334	9	18:45:00
August	0.265	15	22:00:00
September			
October	0.354	29	00:00:00
November	0.723	30	01:15:00
December	0.519	7	06:30:00

Surge minima	Value	Day	Time
January	-0.826	22	12:15:00
February	-0.286	24	00:45:00
March	-0.52	25	00:30:00
April	-0.321	8	08:30:00
May	-0.34	1	13:00:00
June	-0.273	1	01:00:00
July	-0.225	26	10:30:00
August	-0.287	14	19:30:00
September			
October	-0.306	30	22:15:00
November	-0.401	19	06:45:00
December	-0.364	2	04:15:00

Exteme Maxima	Value	Day	Time
January	7.98	12	18:45:00
February	7.649	11	19:15:00
March	7.718	12	18:45:00
April	7.386	10	18:30:00
May	7.226	26	19:00:00
June	7.371	26	08:00:00
July	7.629	25	07:45:00
August	7.181	9	07:30:00
September			
October	6.534	31	16:45:00
November	7.373	18	18:30:00
December	7.279	19	19:30:00

Extreme minima	Value	Day	Time
January	0.518	15	03:15:00
February	0.495	11	01:15:00
March	0.326	12	01:00:00
April	0.746	10	00:30:00
May	0.757	27	14:15:00
June	0.691	25	14:15:00
July	0.488	24	14:00:00
August	1.039	19	11:15:00
September			
October	1.626	31	10:00:00
November	1.069	3	12:15:00
December	0.997	5	01:45:00

Mean sea level	No days	MSL
January	31	4.19
February	28	4.172
March	31	4.142
April	30	4.129
May	31	4.143
June	30	4.179
July	29	4.24
August	18	4.21
September	0	
October	1	4.067
November	21	4.318
December	31	4.31
	Sum	Avg
	281	4.191

## Port Erin (Isle of Man) Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 168: TGI on site to replace the compressor.  
Day 327: TGI on site dealing with communication system fault.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
97	15 minutes	315-326	168

Statistics:

Surge maxima	Value	Day	Time
January	1.065	17	22:00:00
February	0.327	4	00:45:00
March	0.502	7	23:45:00
April	0.506	7	23:00:00
May	0.448	8	04:45:00
June	0.386	17	12:45:00
July	0.469	22	06:45:00
August	0.493	26	10:15:00
September	0.382	8	11:30:00
October	0.441	24	19:00:00
November	0.966	25	13:00:00
December	0.646	6	11:15:00

Surge minima	Value	Day	Time
January	-0.223	6	07:45:00
February	-0.208	21	05:30:00
March	-0.421	28	11:30:00
April	-0.24	22	02:15:00
May	-0.2	3	13:00:00
June	-0.159	1	07:30:00
July	-0.117	17	16:30:00
August	-0.154	28	22:30:00
September	-0.363	10	23:30:00
October	-0.296	16	08:45:00
November	-0.488	8	08:45:00
December	-0.418	18	10:15:00

Exteme Maxima	Value	Day	Time
January	5.846	15	14:00:00
February	5.727	12	13:00:00
March	5.575	12	12:00:00
April	5.638	9	10:45:00
May	5.315	25	23:45:00
June	5.522	26	01:15:00
July	5.79	24	00:15:00
August	5.822	23	00:45:00
September	5.633	21	00:15:00
October	5.716	19	23:45:00
November	5.611	3	11:15:00
December	5.994	6	13:45:00

Extreme minima	Value	Day	Time
January	0.101	13	19:00:00
February	-0.164	11	18:30:00
March	0.005	12	18:15:00
April	0.306	26	05:30:00
May	0.281	28	07:45:00
June	0.112	25	06:45:00
July	-0.046	25	07:15:00
August	-0.061	22	06:15:00
September	-0.098	20	05:45:00
October	0.146	17	04:00:00
November	0.603	5	18:30:00
December	0.491	3	17:45:00

Mean sea level	No days	MSL
January	31	3.042
February	28	2.82
March	31	2.842
April	30	2.863
May	31	2.864
June	30	2.859
July	31	2.962
August	31	2.97
September	30	2.859
October	31	2.991
November	16	3.087
December	31	3.049
	Sum	Avg
	351	2.934

## Port Ellen (Isle of Islay) Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 0.19m below Ordnance Datum Newlyn (ODN)  
TGZ = 2.839m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 203: TGI on site general maintenance and survey for new gauge.  
Day 278 – 281: TGI on site to move gauge away from subsiding site.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
98	15 minutes	120,275-280	280-282

Statistics:

Surge maxima	Value	Day	Time
January	1.305	17	21:45:00
February	0.287	4	03:15:00
March	0.695	7	23:00:00
April	0.628	8	00:00:00
May	0.619	8	02:45:00
June	0.421	17	08:30:00
July	0.53	31	20:15:00
August	0.585	26	10:45:00
September	0.535	8	13:00:00
October	0.67	24	20:30:00
November	0.988	25	10:00:00
December	0.756	6	15:45:00

Surge minima	Value	Day	Time
January	-0.193	5	08:30:00
February	-0.237	19	20:00:00
March	-0.373	28	13:15:00
April	-0.098	21	23:15:00
May	-0.126	3	12:00:00
June	-0.139	23	15:15:00
July	-0.103	17	21:15:00
August	-0.095	13	14:45:00
September	-0.29	10	22:45:00
October	-0.287	16	10:15:00
November	-0.45	8	08:15:00
December	-0.342	18	12:45:00

Exteme Maxima	Value	Day	Time
January	1.804	17	20:45:00
February	1.025	9	05:00:00
March	1.266	14	06:15:00
April	1.264	8	01:30:00
May	1.257	8	02:00:00
June	0.953	26	19:15:00
July	1.252	26	19:45:00
August	1.287	23	19:15:00
September	1.224	8	04:30:00
October	1.472	24	17:30:00
November	1.822	22	16:45:00
December	1.615	6	07:45:00

Extreme minima	Value	Day	Time
January	-0.074	14	00:45:00
February	-0.349	12	00:30:00
March	-0.298	28	12:00:00
April	-0.012	8	22:15:00
May	-0.041	31	13:30:00
June	-0.035	25	12:30:00
July	-0.204	25	13:00:00
August	-0.192	22	11:45:00
September	-0.167	20	11:45:00
October	-0.18	16	09:15:00
November	-0.025	9	00:00:00
December	-0.026	17	23:30:00

Mean sea level	No days	MSL
January	31	0.721
February	28	0.458
March	31	0.493
April	30	0.513
May	31	0.528
June	30	0.501
July	31	0.615
August	31	0.645
September	30	0.529
October	25	0.634
November	30	0.801
December	31	0.665
	Sum	Avg
	359	0.592



## St. Helier (Jersey) Tide Gauge

Latitude: 49° 11' 00" N  
Longitude: 02° 07' 00 " W  
Grid Reference: 13/11 6466 4763

### Benchmarks and Benchmark relationships:

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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 5.88m below Ordnance Datum Local (ODL)  
TGZ = 13.658m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: There were no visits to site in 2009.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	273-274	None

Statistics:

Surge maxima	Value	Day	Time
January	0.892	19	07:00:00
February	0.706	10	02:30:00
March	0.488	3	20:15:00
April	0.306	7	23:45:00
May	0.392	16	09:15:00
June	0.414	9	05:00:00
July	0.433	22	02:45:00
August	0.37	26	07:15:00
September	0.383	3	01:30:00
October	0.27	20	23:15:00
November	0.776	14	11:30:00
December	0.654	30	00:30:00

Surge minima	Value	Day	Time
January	-0.381	6	00:45:00
February	-0.314	26	00:30:00
March	-0.315	22	09:15:00
April	-0.257	20	21:45:00
May	-0.27	11	16:15:00
June	-0.271	23	20:45:00
July	-0.232	24	23:30:00
August	-0.294	21	22:15:00
September	-0.487	10	14:15:00
October	-0.451	16	01:30:00
November	-0.341	8	22:45:00
December	-0.428	18	14:45:00

Exteme Maxima	Value	Day	Time
January	11.54	13	07:45:00
February	11.766	11	07:45:00
March	11.576	12	07:15:00
April	11.285	10	06:45:00
May	10.996	25	19:00:00
June	11.299	25	20:15:00
July	11.638	24	20:15:00
August	11.842	22	19:45:00
September	11.728	19	18:45:00
October	11.303	20	07:15:00
November	11.212	4	06:45:00
December	11.211	5	08:00:00

Extreme minima	Value	Day	Time
January	0.848	13	14:45:00
February	0.468	11	14:30:00
March	0.531	12	14:00:00
April	1.257	10	01:15:00
May	1.187	27	02:30:00
June	1.09	25	02:30:00
July	0.686	25	03:00:00
August	0.45	22	02:00:00
September	0.586	20	01:45:00
October	1.021	18	00:30:00
November	1.833	3	00:30:00
December	1.449	4	14:00:00

Mean sea level	No days	MSL
January	31	6.064
February	28	5.982
March	31	5.95
April	30	5.991
May	31	5.96
June	30	6.029
July	31	6.065
August	31	6.021
September	28	5.954
October	30	6.081
November	30	6.284
December	31	6.189
	Sum	Avg
	362	6.048

## Kinlochbervie Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 2.50m below Ordnance Datum Newlyn (ODN)  
TGZ = 7.213m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: TGI visited during May to reinstate a damaged power supply and repair the logger.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	356-357	None

Statistics:

Surge maxima	Value	Day	Time
January	1.145	18	04:30:00
February	0.283	25	17:30:00
March	0.65	26	13:45:00
April	0.436	7	15:45:00
May	0.689	7	07:00:00
June	0.342	18	10:00:00
July	0.362	12	17:30:00
August	0.41	15	20:00:00
September	0.87	8	16:30:00
October	0.573	3	12:30:00
November	0.928	25	12:30:00
December	0.718	6	17:15:00

Surge minima	Value	Day	Time
January	-0.307	2	00:15:00
February	-0.428	7	06:00:00
March	-0.355	28	03:30:00
April	-0.194	16	07:15:00
May	-0.195	11	23:30:00
June	-0.22	1	02:45:00
July	-0.155	18	00:15:00
August	-0.13	13	22:45:00
September	-0.299	16	18:15:00
October	-0.392	17	00:15:00
November	-0.482	8	19:00:00
December	-0.493	31	03:30:00

Exteme Maxima	Value	Day	Time
January	5.717	12	08:00:00
February	5.265	10	07:30:00
March	5.424	12	08:00:00
April	5.12	9	19:00:00
May	5.063	8	06:30:00
June	4.929	25	21:15:00
July	5.267	22	19:15:00
August	5.487	21	20:00:00
September	5.41	19	19:30:00
October	5.182	20	08:00:00
November	5.277	19	08:30:00
December	5.444	6	10:00:00

Extreme minima	Value	Day	Time
January	0.333	13	15:00:00
February	-0.045	11	15:00:00
March	0.185	28	14:30:00
April	0.468	25	13:30:00
May	0.716	28	04:00:00
June	0.38	25	03:00:00
July	0.186	25	03:30:00
August	0.22	22	02:30:00
September	0.194	20	02:00:00
October	0.302	17	00:15:00
November	0.824	5	15:00:00
December	0.683	31	13:15:00

Mean sea level	No days	MSL
January	31	3.088
February	28	2.789
March	31	2.862
April	30	2.816
May	31	2.849
June	30	2.779
July	31	2.897
August	31	2.969
September	30	2.915
October	31	2.971
November	30	3.133
December	29	2.974
	Sum	Avg
	363	2.92

## Leith Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 2.90m below Ordnance Datum Newlyn (ODN)  
TGZ = 7.84mm below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 068:	TGI on site to replace the compressor and memory card and carry out general maintenance.
	Day 286:	TGI on site to replace heater in gauge building.
	Day 349:	TGI on site to carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	68	None

Statistics:

Surge maxima	Value	Day	Time
January	1.017	18	14:45:00
February	0.357	3	00:15:00
March	0.427	3	23:15:00
April	0.447	7	22:45:00
May	0.562	7	19:45:00
June	0.32	18	05:45:00
July	0.298	13	02:00:00
August	0.353	26	02:15:00
September	0.903	9	00:45:00
October	0.434	6	23:30:00
November	0.554	1	15:45:00
December	0.566	7	13:00:00

Surge minima	Value	Day	Time
January	-0.506	22	09:30:00
February	-0.343	1	00:45:00
March	-0.422	17	22:30:00
April	-0.284	20	21:00:00
May	-0.256	1	10:30:00
June	-0.315	1	08:15:00
July	-0.156	18	13:00:00
August	-0.229	28	09:00:00
September	-0.325	5	18:30:00
October	-0.425	25	01:30:00
November	-0.445	9	02:15:00
December	-0.315	18	11:00:00

Exteme Maxima	Value	Day	Time
January	6.285	12	15:15:00
February	5.948	10	02:45:00
March	5.94	12	15:30:00
April	5.773	27	16:00:00
May	5.778	26	15:45:00
June	5.697	25	16:30:00
July	6.035	23	15:30:00
August	6.071	21	02:30:00
September	6.091	20	03:00:00
October	5.893	19	02:45:00
November	5.889	3	02:15:00
December	5.808	5	04:15:00

Extreme minima	Value	Day	Time
January	0.302	13	22:45:00
February	0.11	11	22:00:00
March	0.1	11	21:00:00
April	0.467	9	20:30:00
May	0.656	28	11:15:00
June	0.28	25	10:30:00
July	0.115	24	10:15:00
August	0.039	21	09:00:00
September	0.2	20	09:15:00
October	0.391	17	07:30:00
November	0.803	17	08:15:00
December	0.713	4	22:00:00

Mean sea level	No days	MSL
January	31	3.245
February	28	3.132
March	31	3.121
April	30	3.121
May	31	3.139
June	30	3.139
July	31	3.246
August	31	3.235
September	30	3.214
October	31	3.233
November	30	3.358
December	31	3.303
	Sum	Avg
	365	3.207

## Lerwick Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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.

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: There were no visits to site in 2009.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	346,356-358	None

Statistics:

Surge maxima	Value	Day	Time
January	0.542	18	18:30:00
February	0.229	25	19:15:00
March	0.453	8	02:15:00
April	0.305	11	06:45:00
May	0.544	7	23:15:00
June	0.298	18	04:15:00
July	0.232	13	18:15:00
August	0.26	24	07:45:00
September	0.362	9	04:45:00
October	0.404	3	11:30:00
November	0.52	25	13:45:00
December	0.362	7	14:30:00

Surge minima	Value	Day	Time
January	-0.338	2	06:45:00
February	-0.266	13	13:45:00
March	-0.23	19	06:30:00
April	-0.141	20	21:30:00
May	-0.168	12	05:30:00
June	-0.172	1	04:30:00
July	-0.09	26	02:00:00
August	-0.081	13	17:30:00
September	-0.233	13	21:15:00
October	-0.264	17	03:30:00
November	-0.285	9	00:00:00
December	-0.322	17	19:30:00

Exteme Maxima	Value	Day	Time
January	2.823	12	11:30:00
February	2.322	10	11:15:00
March	2.427	12	11:45:00
April	2.273	8	09:45:00
May	2.418	7	22:15:00
June	2.117	25	00:00:00
July	2.412	22	23:15:00
August	2.506	21	23:30:00
September	2.478	22	00:45:00
October	2.451	6	23:45:00
November	2.543	19	12:15:00
December	2.551	7	14:30:00

Extreme minima	Value	Day	Time
January	0.136	14	19:15:00
February	-0.033	11	18:15:00
March	0.165	11	17:15:00
April	0.301	28	06:30:00
May	0.278	28	07:45:00
June	0.066	25	06:30:00
July	0.11	25	07:00:00
August	0.168	21	05:00:00
September	0.183	18	04:00:00
October	0.12	17	03:30:00
November	0.462	8	21:15:00
December	0.329	31	16:15:00

Mean sea level	No days	MSL
January	31	1.436
February	28	1.246
March	31	1.296
April	30	1.224
May	31	1.266
June	30	1.226
July	31	1.342
August	31	1.369
September	30	1.363
October	31	1.359
November	30	1.526
December	24	1.399
	Sum	Avg
	358	1.338



## Liverpool Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 4.93m below Ordnance Datum Newlyn (ODN)  
TGZ = 14.475m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 069: TGI on site to test instrumentation on ADSL line.  
Day 159: TGI on site to fit new counter board.  
Day 161: TGI on site to fit software patch.  
Day 323 - 324: TGI on site to reboot data logger.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
98	15 minutes	133-134,158-161,196,323-324	028-031,075-158,161-218,231-239,245-246,249-255,259-264,267,278-281,288-294,304-307,311-315,317-320,322,325-326,323-337,338-343,346,349,353,365

Statistics:

Surge maxima	Value	Day	Time
January	1.369	17	23:00:00
February	0.508	4	01:30:00
March	0.985	3	21:45:00
April			
May			
June			
July			
August	0.617	27	22:00:00
September	0.764	3	04:45:00
October	0.738	24	18:30:00
November	1.326	25	12:45:00
December	0.799	6	10:15:00

Surge minima	Value	Day	Time
January	-0.264	6	07:00:00
February	-0.492	1	09:00:00
March	-0.206	14	22:30:00
April			
May			
June			
July			
August	-0.226	22	08:30:00
September	-0.373	10	20:30:00
October	-0.423	16	05:30:00
November	-0.462	8	11:15:00
December	-0.547	18	08:45:00

Exteme Maxima	Value	Day	Time
January	10.023	13	12:30:00
February	10.071	11	12:00:00
March	9.961	12	11:45:00
April			
May			
June			
July			
August	10.185	21	23:45:00
September	9.997	19	23:15:00
October	9.695	18	23:00:00
November	9.788	3	11:00:00
December	9.917	6	13:15:00

Extreme minima	Value	Day	Time
January	0.744	13	19:45:00
February	0.381	11	19:30:00
March	0.627	12	19:00:00
April			
May			
June			
July			
August	0.467	22	07:15:00
September	0.48	20	06:45:00
October	0.923	17	04:45:00
November	1.559	3	05:30:00
December	1.187	4	19:00:00

Mean sea level	No days	MSL
January	31	5.438
February	28	5.259
March	15	5.367
April	0	
May	0	
June	0	
July	0	
August	18	5.401
September	22	5.352
October	27	5.446
November	13	5.674
December	20	5.404
	Sum	Avg
	174	5.418

## Llandudno Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 3.85m below Ordnance Datum Newlyn (ODN)  
TGZ = 12.558m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: There were no visits to site in 2009.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
100	15 minutes	None	019,333-334

Statistics:

Surge maxima	Value	Day	Time
January	1.083	18	00:15:00
February	0.39	4	01:15:00
March	0.612	3	21:00:00
April	0.558	8	03:30:00
May	0.471	16	11:45:00
June	0.414	17	13:15:00
July	0.453	22	06:45:00
August	0.479	26	10:00:00
September	0.354	8	14:15:00
October	0.473	24	17:00:00
November	1.091	25	12:45:00
December	0.65	6	10:45:00

Surge minima	Value	Day	Time
January	-0.288	6	06:15:00
February	-0.411	1	08:45:00
March	-0.564	28	08:45:00
April	-0.247	22	00:30:00
May	-0.277	3	15:00:00
June	-0.262	6	10:30:00
July	-0.326	17	12:00:00
August	-0.236	28	19:30:00
September	-0.396	11	00:45:00
October	-0.512	11	22:45:00
November	-0.546	8	09:45:00
December	-0.579	18	08:45:00

Exteme Maxima	Value	Day	Time
January	8.174	13	12:00:00
February	8.191	11	11:45:00
March	8.061	12	11:30:00
April	7.921	9	10:30:00
May	7.668	25	23:15:00
June	7.891	26	00:45:00
July	8.224	23	23:45:00
August	8.318	21	23:15:00
September	8.147	19	23:00:00
October	7.985	19	23:15:00
November	7.924	3	10:45:00
December	8.141	6	13:15:00

Extreme minima	Value	Day	Time
January	0.08	13	19:00:00
February	-0.239	11	18:30:00
March	-0.044	12	18:15:00
April	0.355	26	05:30:00
May	0.433	26	06:00:00
June	0.166	25	06:45:00
July	-0.08	25	07:15:00
August	-0.169	22	06:15:00
September	-0.145	20	05:45:00
October	0.219	17	04:00:00
November	0.752	5	18:30:00
December	0.548	3	17:30:00

Mean sea level	No days	MSL
January	31	4.183
February	28	3.973
March	31	3.994
April	30	4.02
May	31	4.016
June	30	4.026
July	31	4.121
August	31	4.122
September	30	4.013
October	31	4.142
November	27	4.341
December	30	4.182
	Sum	Avg
	361	4.094

## Lowestoft Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 1.50m below Ordnance Datum Newlyn (ODN)  
TGZ = 4.483m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 240: TGI on site to repair mid tide and adjust datum.  
Day 330: TGI on site to carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	236	038-040,048,057-058,172-175,201-212,225-241

Statistics:

Surge maxima	Value	Day	Time
January	0.923	18	20:30:00
February	0.533	10	10:45:00
March	0.781	24	04:30:00
April	0.244	12	07:00:00
May	0.394	26	18:00:00
June	0.338	18	10:00:00
July	0.465	10	07:00:00
August	0.295	29	08:15:00
September	0.904	9	07:00:00
October	0.885	4	05:00:00
November	0.617	23	13:30:00
December	0.483	28	01:15:00

Surge minima	Value	Day	Time
January	-0.924	22	10:30:00
February	-0.396	1	00:30:00
March	-0.506	4	01:45:00
April	-0.295	21	06:00:00
May	-0.325	4	20:00:00
June	-0.339	17	13:30:00
July	-0.186	19	23:00:00
August	-0.273	31	03:15:00
September	-0.413	8	18:45:00
October	-0.455	25	09:15:00
November	-0.555	14	19:00:00
December	-0.501	2	06:00:00

Exteme Maxima	Value	Day	Time
January	3.053	12	22:15:00
February	2.969	10	10:15:00
March	2.981	28	22:15:00
April	2.689	10	21:45:00
May	2.706	26	23:00:00
June	2.704	26	11:45:00
July	2.873	10	10:30:00
August	2.676	11	12:00:00
September	3.342	9	11:00:00
October	3.318	4	09:00:00
November	2.893	30	07:00:00
December	2.77	8	01:15:00

Extreme minima	Value	Day	Time
January	0.045	15	06:30:00
February	0.226	11	04:45:00
March	0.033	12	04:30:00
April	0.302	10	04:00:00
May	0.267	27	17:45:00
June	0.275	25	17:45:00
July	0.626	11	18:15:00
August	0.533	9	17:45:00
September	0.25	8	17:45:00
October	0.316	17	14:45:00
November	0.341	3	15:30:00
December	0.378	6	06:30:00

Mean sea level	No days	MSL
January	31	1.603
February	18	1.601
March	31	1.618
April	30	1.564
May	31	1.584
June	26	1.652
July	19	1.726
August	14	1.67
September	30	1.724
October	31	1.704
November	30	1.732
December	31	1.75
	Sum	Avg
	322	1.661

## Milford Haven Tide Gauge

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

### Benchmarks and Benchmark relationships:

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

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: Geodetic levelling performed on day 198.

TGI visits to site: Day 188: TGI on site to replace the compressor and carry out general maintenance.  
Day 285: TGI on site to replace a faulty compressor.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	280-285	207-229,233-280,285-288,315-317

Statistics:

Surge maxima	Value	Day	Time
January	0.998	17	17:15:00
February	0.459	3	20:30:00
March	0.58	3	15:30:00
April	0.555	7	22:15:00
May	0.586	16	07:15:00
June	0.37	8	16:45:00
July	0.565	22	01:30:00
August	0.464	20	01:45:00
September			
October	0.456	21	04:30:00
November	1.077	14	09:30:00
December	0.636	6	05:45:00

Surge minima	Value	Day	Time
January	-0.223	6	02:30:00
February	-0.177	19	02:30:00
March	-0.209	23	22:30:00
April	-0.188	21	19:45:00
May	-0.175	5	05:00:00
June	-0.126	22	07:15:00
July	-0.197	17	13:30:00
August	0.033	18	05:45:00
September			
October	-0.212	16	02:45:00
November	-0.344	8	11:15:00
December	-0.278	18	15:15:00

Exteme Maxima	Value	Day	Time
January	7.572	13	07:45:00
February	7.57	11	07:15:00
March	7.438	12	07:00:00
April	7.409	9	18:15:00
May	7.061	25	18:45:00
June	7.318	25	20:15:00
July	7.583	23	19:15:00
August	7.509	20	18:15:00
September			
October	7.489	19	18:45:00
November	7.363	18	06:45:00
December	7.48	6	08:30:00

Extreme minima	Value	Day	Time
January	0.564	13	14:00:00
February	0.305	11	13:45:00
March	0.347	12	13:15:00
April	0.821	26	13:00:00
May	0.809	27	01:45:00
June	0.723	25	01:45:00
July	0.447	25	02:15:00
August	0.489	21	13:00:00
September			
October	0.663	17	23:45:00
November	1.107	3	00:00:00
December	0.968	4	01:00:00

Mean sea level	No days	MSL
January	31	4.013
February	28	3.855
March	31	3.836
April	30	3.897
May	31	3.87
June	30	3.912
July	25	3.977
August	2	4.055
September	0	
October	16	4.047
November	27	4.176
December	31	4.106
	Sum	Avg
	282	3.977



## Millport Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	Description
TGBM	NS 1757 5449	FI 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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 1.62m below Ordnance Datum Newlyn (ODN)  
TGZ = 7.825m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: There were no visits to site in 2009.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	021,257-259	None

Statistics:

Surge maxima	Value	Day	Time
January	1.305	17	22:15:00
February	0.262	4	04:15:00
March	0.698	7	21:45:00
April	0.613	9	16:45:00
May	0.743	8	00:30:00
June	0.457	17	10:30:00
July	0.509	26	11:30:00
August	0.551	26	11:15:00
September	0.545	8	12:30:00
October	0.716	24	18:30:00
November	1.046	25	09:30:00
December	0.772	6	15:15:00

Surge minima	Value	Day	Time
January	-0.338	5	07:15:00
February	-0.388	19	19:45:00
March	-0.49	28	13:30:00
April	-0.231	15	20:45:00
May	-0.234	3	13:15:00
June	-0.185	23	14:45:00
July	-0.189	17	19:45:00
August	-0.211	13	13:30:00
September	-0.403	11	00:45:00
October	-0.391	16	10:30:00
November	-0.545	8	08:30:00
December	-0.483	18	06:30:00

Exteme Maxima	Value	Day	Time
January	4.129	16	16:00:00
February	3.845	12	14:00:00
March	3.773	26	12:15:00
April	3.813	9	11:45:00
May	3.722	7	23:45:00
June	3.65	27	03:00:00
July	3.917	27	03:30:00
August	4.032	25	03:15:00
September	3.944	22	02:00:00
October	3.844	20	00:45:00
November	4.263	19	13:30:00
December	4.462	6	14:45:00

Extreme minima	Value	Day	Time
January	0.14	13	19:30:00
February	-0.059	11	19:00:00
March	-0.032	28	18:45:00
April	0.245	28	07:30:00
May	0.116	29	09:00:00
June	0.059	25	07:15:00
July	-0.024	25	07:45:00
August	0.095	22	06:45:00
September	-0.002	20	06:15:00
October	0.076	16	03:45:00
November	0.251	30	03:30:00
December	0.309	17	18:30:00

Mean sea level	No days	MSL
January	31	2.175
February	28	1.904
March	31	1.953
April	30	1.953
May	31	1.984
June	30	1.936
July	31	2.046
August	31	2.091
September	25	2.013
October	31	2.089
November	30	2.287
December	31	2.127
	Sum	Avg
	360	2.047

## Mumbles Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 5.00m below Ordnance Datum Newlyn (ODN)  
TGZ = 13.821m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 056:	TGI on site to carry out general maintenance.
	Day 262 - 264:	TGI & divers on site - to install new pressure sensors.
	Day 335:	TGI on site to investigate a communications fault.
	Day 350:	TGI on site to replace sensor.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
96	15 minutes	042-055,182	009-013,210-212,220- 222,227-234,263,350

Statistics:

Surge maxima	Value	Day	Time
January	1.095	17	18:30:00
February	0.434	5	10:15:00
March	0.709	3	16:45:00
April	0.63	7	23:30:00
May	0.543	16	07:45:00
June	0.29	26	04:15:00
July	0.488	22	02:00:00
August	0.415	26	05:00:00
September	0.441	2	21:45:00
October	0.338	24	09:00:00
November	1.152	14	10:30:00
December	0.572	6	07:00:00

Surge minima	Value	Day	Time
January	-0.339	6	03:00:00
February	-0.22	26	03:30:00
March	-0.364	22	10:15:00
April	-0.313	21	20:30:00
May	-0.281	3	22:00:00
June	-0.197	21	06:45:00
July	-0.249	17	12:45:00
August	-0.219	29	01:00:00
September	-0.325	10	16:45:00
October	-0.316	16	01:45:00
November	-0.392	8	11:00:00
December	-0.452	18	15:45:00

Exteme Maxima	Value	Day	Time
January	9.897	14	08:30:00
February	9.917	10	06:45:00
March	9.96	12	07:00:00
April	9.813	9	18:15:00
May	9.514	27	08:00:00
June	9.761	25	20:15:00
July	10.11	23	19:15:00
August	10.215	22	19:45:00
September	10.119	19	18:30:00
October	9.876	19	18:45:00
November	9.674	18	06:45:00
December	9.801	6	08:45:00

Extreme minima	Value	Day	Time
January	0.844	13	14:00:00
February	0.54	11	01:00:00
March	0.511	13	01:15:00
April	0.968	26	12:45:00
May	1.096	26	13:15:00
June	1.015	25	01:45:00
July	0.698	25	02:15:00
August	0.508	22	13:15:00
September	0.498	20	00:45:00
October	0.852	18	12:00:00
November	1.331	2	23:45:00
December	1.181	4	01:00:00

Mean sea level	No days	MSL
January	27	5.317
February	13	5.239
March	31	5.153
April	30	5.198
May	31	5.176
June	30	5.215
July	27	5.292
August	13	5.255
September	27	5.163
October	31	5.284
November	30	5.461
December	29	5.362
	Sum	Avg
	319	5.26

## Newlyn Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 3.05m below Ordnance Datum Newlyn (ODN)  
TGZ = 7.801m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Ordnance Datum Newlyn (ODN) is based on mean sea level at Newlyn between 1915 and 1921 (inclusive).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 181: TGI on site to carry out general maintenance.  
Day 337: TGI on site to replace a compressor.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	70	317-318,337

Statistics:

Surge maxima	Value	Day	Time
January	0.54	25	15:30:00
February	0.609	4	18:30:00
March	0.351	4	00:00:00
April	0.372	9	15:45:00
May	0.361	17	08:45:00
June	0.364	8	15:30:00
July	0.312	14	18:45:00
August	0.314	26	04:30:00
September	0.259	2	13:30:00
October	0.38	20	00:45:00
November	0.704	14	07:30:00
December	0.537	30	11:00:00

Surge minima	Value	Day	Time
January	-0.212	8	06:30:00
February	-0.17	21	00:00:00
March	-0.18	22	20:30:00
April	-0.189	21	20:15:00
May	-0.249	5	03:00:00
June	-0.116	1	00:15:00
July	-0.188	17	23:00:00
August	-0.195	28	22:45:00
September	-0.201	10	13:45:00
October	-0.238	16	04:45:00
November	-0.28	8	13:00:00
December	-0.201	18	12:45:00

Exteme Maxima	Value	Day	Time
January	5.957	13	06:00:00
February	5.957	11	05:45:00
March	5.761	13	06:00:00
April	5.82	9	16:45:00
May	5.569	25	17:15:00
June	5.829	25	18:30:00
July	5.971	23	17:30:00
August	6.04	22	18:00:00
September	5.92	19	17:00:00
October	5.915	20	05:30:00
November	5.815	16	03:45:00
December	5.909	6	07:00:00

Extreme minima	Value	Day	Time
January	0.568	13	13:00:00
February	0.416	11	12:30:00
March	0.4	12	12:15:00
April	0.831	27	00:15:00
May	0.696	27	01:00:00
June	0.755	23	23:45:00
July	0.464	25	01:15:00
August	0.402	22	00:15:00
September	0.438	19	23:45:00
October	0.667	17	22:30:00
November	1.067	5	12:30:00
December	0.918	3	11:30:00

Mean sea level	No days	MSL
January	31	3.31
February	28	3.202
March	31	3.151
April	30	3.221
May	31	3.17
June	30	3.251
July	31	3.267
August	31	3.231
September	30	3.181
October	31	3.31
November	27	3.403
December	31	3.41
	Sum	Avg
	362	3.259

## Newhaven Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 062:	TGI on site to survey for mid tide, and carry out general maintenance and memory upgrade.
	Day 178:	TGI on site to carry out general maintenance.
	Day 202:	TGI & divers on site - to install mid tide and clean full tide pressure points.
	Day 300:	TGI on site to carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	058,062,098,123,327	200

Statistics:

Surge maxima	Value	Day	Time
January	0.924	23	07:30:00
February	0.569	9	22:15:00
March	0.459	8	19:45:00
April	0.282	8	04:00:00
May	0.271	17	15:15:00
June	0.258	7	09:30:00
July	0.24	7	09:45:00
August	0.182	2	06:45:00
September	0.306	2	20:15:00
October	0.404	4	11:30:00
November	0.635	29	06:15:00
December	0.46	29	18:45:00

Surge minima	Value	Day	Time
January	-0.376	6	02:15:00
February	-0.323	1	11:15:00
March	-0.345	15	23:45:00
April	-0.242	23	16:30:00
May	-0.341	11	22:30:00
June	-0.203	1	07:15:00
July	-0.158	15	17:00:00
August	-0.215	15	06:15:00
September	-0.383	10	10:45:00
October	-0.3	17	08:00:00
November	-0.463	14	21:30:00
December	-0.4	18	20:45:00

Exteme Maxima	Value	Day	Time
January	7.074	14	01:15:00
February	7.246	9	23:15:00
March	7.046	13	00:30:00
April	6.899	10	23:45:00
May	6.783	25	23:45:00
June	6.857	26	13:45:00
July	7.013	23	12:00:00
August	7.11	22	12:30:00
September	7.2	20	12:00:00
October	7.024	7	12:30:00
November	7.067	4	11:45:00
December	6.914	5	00:45:00

Extreme minima	Value	Day	Time
January	0.558	13	19:15:00
February	0.364	11	18:45:00
March	0.344	11	17:45:00
April	0.6	8	16:45:00
May	0.664	25	05:15:00
June	0.565	25	07:00:00
July	0.479	25	07:30:00
August	0.373	22	06:30:00
September	0.432	21	06:45:00
October	0.573	18	17:15:00
November	0.896	18	18:00:00
December	0.828	4	18:45:00

Mean sea level	No days	MSL
January	31	3.642
February	28	3.601
March	31	3.587
April	30	3.588
May	31	3.563
June	30	3.631
July	31	3.679
August	31	3.644
September	30	3.614
October	31	3.688
November	27	3.836
December	31	3.774
	Sum	Avg
	362	3.654



## Newport Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 062: TGI on site to fit new modem  
Day 168: TGI on site to repair mid tide

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	056-059,113	013-014,170-218,286- 294,306,308-309,322- 326,328-353,355-365

Statistics:

Surge maxima	Value	Day	Time
January	1.783	17	18:45:00
February	0.856	11	15:00:00
March	1.155	3	18:15:00
April	1.219	8	01:30:00
May	0.952	16	17:30:00
June	0.544	6	01:15:00
July			
August	0.86	20	13:15:00
September	0.923	2	23:30:00
October	0.589	24	17:00:00
November	1.757	14	12:30:00
December	0.751	30	13:15:00

Surge minima	Value	Day	Time
January	-0.505	31	04:30:00
February	-0.707	1	05:00:00
March	-0.638	15	04:30:00
April	-0.55	23	12:30:00
May	-0.674	12	03:30:00
June	-0.311	12	16:00:00
July			
August	-0.66	22	16:00:00
September	-0.799	10	04:30:00
October	-0.78	7	03:30:00
November	-0.469	8	13:00:00
December	-0.526	20	03:30:00

Exteme Maxima	Value	Day	Time
January	12.971	13	08:30:00
February	13.051	11	08:15:00
March	12.884	12	08:00:00
April	12.522	9	19:00:00
May	12.244	27	09:00:00
June	12.023	24	08:00:00
July			
August	13.1	22	20:30:00
September	13.086	19	19:30:00
October	12.431	6	20:15:00
November	12.426	4	20:00:00
December	11.41	31	06:15:00

Extreme minima	Value	Day	Time
January	0.445	14	16:30:00
February	0.326	12	04:15:00
March	0.206	13	03:45:00
April	0.363	26	14:45:00
May	0.55	26	02:45:00
June	1.154	9	02:00:00
July			
August	0.138	22	03:30:00
September	0.19	21	15:45:00
October	0.343	7	03:30:00
November	0.776	3	01:30:00
December	1.07	31	13:00:00

Mean sea level	No days	MSL
January	29	6.242
February	23	6.108
March	31	6.158
April	30	6.161
May	31	6.147
June	17	6.177
July	0	
August	25	6.23
September	30	6.133
October	22	6.262
November	12	6.371
December	0	
	Sum	Avg
	250	6.199

## North Shields Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 2.60m below Ordnance Datum Newlyn (ODN)  
TGZ = 6.754m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 068:	TGI on site to carry out general maintenance and memory update.
	Day 159:	TGI on site to carry out general maintenance and survey.
	Day 235:	TGI on site to survey the RNLI jetty.
	Day 295:	TGI on site to carry out general maintenance.
	Day 330:	TGI on site to remove gauge equipment until re-housed in new building.
	Day 340:	Divers on site to install new gauge equipment.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
95	15 minutes	063-068,074,330-341	None

Statistics:

Surge maxima	Value	Day	Time
January	1.012	18	15:15:00
February	0.251	10	03:30:00
March	0.334	23	23:30:00
April	0.324	7	23:45:00
May	0.477	7	22:15:00
June	0.287	18	06:45:00
July	0.313	18	02:45:00
August	0.263	26	04:15:00
September	0.784	9	02:00:00
October	0.504	3	22:45:00
November	0.495	26	07:15:00
December			

Surge minima	Value	Day	Time
January	-0.533	22	11:00:00
February	-0.326	1	03:00:00
March	-0.374	17	23:45:00
April	-0.272	20	22:15:00
May	-0.243	29	23:45:00
June	-0.227	1	01:45:00
July	-0.129	26	14:45:00
August	-0.202	14	18:30:00
September	-0.321	8	13:00:00
October	-0.398	25	02:15:00
November	-0.385	9	03:45:00
December			

Exteme Maxima	Value	Day	Time
January	5.866	12	16:15:00
February	5.444	10	15:45:00
March	5.542	12	16:15:00
April	5.289	10	15:45:00
May	5.289	26	16:45:00
June	5.212	26	05:30:00
July	5.482	25	05:15:00
August	5.56	22	04:00:00
September	5.709	20	03:45:00
October	5.488	7	04:45:00
November	5.408	3	03:00:00
December			

Extreme minima	Value	Day	Time
January	0.205	15	00:30:00
February	0.126	10	22:30:00
March	0.061	11	22:15:00
April	0.37	9	21:45:00
May	0.536	28	12:30:00
June	0.207	25	11:30:00
July	0.105	24	11:15:00
August	0.04	22	10:45:00
September	0.163	19	09:45:00
October	0.279	17	08:45:00
November	0.83	3	09:45:00
December			

Mean sea level	No days	MSL
January	31	2.988
February	28	2.912
March	23	2.871
April	30	2.857
May	31	2.887
June	30	2.896
July	31	3.008
August	31	2.982
September	30	2.996
October	31	2.982
November	24	3.106
December	0	
	Sum	Avg
	320	2.953

## Portpatrick Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 1.80m below Ordnance Datum Newlyn (ODN)  
TGZ = 6.827m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: Geodetic levelling was carried out at site on days 40 – 42.

TGI visits to site:	Day 014:	TGI on site to replace compressor.
	Day 040 - 042:	TGI on site to replace old tide gauge and carry out general maintenance.
	Day 315:	TGI on site to install mid tide.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
98	15 minutes	245,315-318,336,356	003-009,034-043,049-050,056,059-062,254,257-258,279-281,285-286,288,290,364-365

Statistics:

Surge maxima	Value	Day	Time
January	1.186	17	22:15:00
February	0.281	4	03:15:00
March	0.547	7	22:15:00
April	0.595	8	00:30:00
May	0.574	8	01:45:00
June	0.384	17	10:00:00
July	0.485	22	08:15:00
August	0.591	26	10:15:00
September	0.463	8	11:30:00
October	0.572	24	19:45:00
November	0.965	25	12:30:00
December	0.673	1	20:15:00

Surge minima	Value	Day	Time
January	-0.251	5	07:15:00
February	-0.256	19	19:45:00
March	-0.431	28	11:15:00
April	-0.168	22	01:45:00
May	-0.197	3	13:00:00
June	-0.154	1	08:45:00
July	-0.123	17	18:00:00
August	-0.128	28	19:15:00
September	-0.329	10	23:30:00
October	-0.333	16	09:15:00
November	-0.5	8	08:45:00
December	-0.431	18	11:00:00

Exteme Maxima	Value	Day	Time
January	4.569	15	14:30:00
February	4.332	12	13:15:00
March	4.174	26	11:30:00
April	4.275	9	11:15:00
May	4.01	8	10:45:00
June	4.143	27	02:30:00
July	4.331	24	00:30:00
August	4.405	23	01:00:00
September	4.313	22	01:15:00
October	4.32	20	00:00:00
November	4.657	19	12:45:00
December	4.737	6	14:15:00

Extreme minima	Value	Day	Time
January	0.171	13	19:30:00
February	-0.052	11	19:00:00
March	0.06	28	18:45:00
April	0.329	28	07:15:00
May	0.211	29	09:00:00
June	0.137	25	07:00:00
July	0.036	25	07:30:00
August	0.097	22	06:30:00
September	0.034	20	06:00:00
October	0.174	16	03:30:00
November	0.42	30	03:30:00
December	0.429	17	18:15:00

Mean sea level	No days	MSL
January	31	2.352
February	27	2.105
March	31	2.127
April	30	2.15
May	31	2.165
June	30	2.141
July	31	2.251
August	31	2.276
September	30	2.158
October	31	2.28
November	24	2.456
December	31	2.301
	Sum	Avg
	358	2.23

## Portrush Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	Description
TGBM	Sheet 6 C 8556 4079	Pin RNLI slipway
Aux1	Sheet 6 C 8567 4070	Cut mark wall Kerr St
Aux2	Sheet 6 C 8580 4055	Cut mark wall Kerr St

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 1.24m below Ordnance Datum Belfast (ODB)  
TGZ = 2.844m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: There were no visits to site in 2009.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	001,056,301	None

Statistics:

Surge maxima	Value	Day	Time
January	1.192	17	21:45:00
February	0.179	8	18:00:00
March	0.588	7	22:00:00
April	0.379	9	15:45:00
May	0.484	7	22:30:00
June	0.289	17	08:00:00
July	0.415	12	08:30:00
August	0.448	27	21:15:00
September	0.421	8	12:45:00
October	0.535	24	20:30:00
November	0.897	25	09:30:00
December	0.655	6	09:00:00

Surge minima	Value	Day	Time
January	-0.265	5	09:00:00
February	-0.301	19	20:00:00
March	-0.366	28	11:30:00
April	-0.231	21	22:30:00
May	-0.192	31	18:00:00
June	-0.211	23	15:15:00
July	-0.159	8	08:30:00
August	-0.17	13	14:15:00
September	-0.357	10	22:45:00
October	-0.341	16	10:30:00
November	-0.458	8	08:00:00
December	-0.435	31	02:15:00

Exteme Maxima	Value	Day	Time
January	2.715	12	07:15:00
February	2.461	10	06:45:00
March	2.426	26	06:00:00
April	2.365	8	05:45:00
May	2.319	8	06:00:00
June	2.235	25	20:30:00
July	2.566	23	19:15:00
August	2.634	20	18:30:00
September	2.446	18	18:00:00
October	2.448	20	07:15:00
November	2.605	19	07:30:00
December	2.867	6	09:00:00

Extreme minima	Value	Day	Time
January	0.198	14	02:00:00
February	-0.084	12	01:30:00
March	-0.007	28	13:15:00
April	0.244	26	00:45:00
May	0.349	25	12:45:00
June	0.235	23	12:30:00
July	0.117	25	14:15:00
August	0.057	22	13:15:00
September	0.085	20	12:45:00
October	0.171	16	23:30:00
November	0.552	8	17:45:00
December	0.294	18	01:15:00

Mean sea level	No days	MSL
January	31	1.413
February	28	1.193
March	31	1.217
April	30	1.218
May	31	1.242
June	30	1.218
July	31	1.323
August	31	1.361
September	30	1.254
October	31	1.349
November	30	1.515
December	31	1.394
	Sum	Avg
	365	1.308



## Portbury Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 6.50m below Ordnance Datum Newlyn (ODN)  
TGZ = 9.226m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 014:	TGI on site to replace compressor.
	Day 027:	TGI on site general maintenance.
	Day 064:	TGI on site to replace modem SIM card.
	Day 198:	TGI on site to repair cabinet heater.
	Day 231:	TGI on site to fix problem with power supply.
	Day 246:	TGI on site to investigate communication problems.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
100	15 minutes	?????	?????

Statistics:

Surge maxima	Value	Day	Time
January	1.792	17	19:30:00
February			
March	1.154	8	13:00:00
April	1.401	8	01:45:00
May	1.09	16	18:00:00
June	0.74	26	06:00:00
July	0.718	12	05:30:00
August	0.763	26	06:30:00
September	1.025	3	00:00:00
October	0.806	6	16:00:00
November	1.765	14	12:45:00
December	1.043	5	04:30:00

Surge minima	Value	Day	Time
January	-0.549	8	09:30:00
February			
March	-0.687	22	10:00:00
April	-0.63	20	21:45:00
May	-0.499	12	03:30:00
June	-0.352	21	19:00:00
July	-0.311	9	15:00:00
August	-0.368	15	14:45:00
September	-0.682	10	16:45:00
October	-0.622	28	21:00:00
November	-0.486	28	22:00:00
December	-0.629	19	03:15:00

Exteme Maxima	Value	Day	Time
January	14.151	13	08:45:00
February			
March	14.04	12	08:00:00
April	13.675	9	19:15:00
May	13.38	26	20:30:00
June	13.613	25	21:15:00
July	12.751	27	11:00:00
August	14.063	23	21:30:00
September	14.252	19	19:45:00
October	13.695	19	19:45:00
November	13.623	4	20:00:00
December	13.679	6	09:30:00

Extreme minima	Value	Day	Time
January	0.803	14	04:15:00
February			
March	0.501	13	03:30:00
April	0.919	26	02:30:00
May	1.107	25	14:30:00
June	0.966	25	03:30:00
July	1.588	27	05:30:00
August	0.993	24	04:30:00
September	0.529	20	15:15:00
October	0.947	18	14:00:00
November	1.525	3	01:45:00
December	1.301	4	02:45:00

Mean sea level	No days	MSL
January	19	7.047
February	0	
March	26	6.981
April	30	6.992
May	31	6.992
June	16	7.041
July	11	7.085
August	25	7.049
September	30	7
October	31	7.124
November	30	7.32
December	31	7.138
	Sum	Avg
	280	7.07

## Portsmouth Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 2.73m below Ordnance Datum Newlyn (ODN)  
TGZ = 6.007m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 061 – 062: TGI on site to carry out maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
100	15 minutes	None	61

Statistics:

Surge maxima	Value	Day	Time
January	0.856	23	08:00:00
February	0.612	9	23:30:00
March	0.629	3	21:00:00
April	0.373	8	02:45:00
May	0.332	17	08:15:00
June	0.254	7	10:15:00
July	0.289	15	01:00:00
August	0.242	25	06:30:00
September	0.418	2	19:45:00
October	0.367	7	14:30:00
November	0.783	14	13:15:00
December	0.509	6	06:15:00

Surge minima	Value	Day	Time
January	-0.375	6	02:00:00
February	-0.289	1	15:00:00
March	-0.348	18	08:00:00
April	-0.276	22	02:00:00
May	-0.315	12	05:45:00
June	-0.239	1	06:30:00
July	-0.203	26	15:45:00
August	-0.241	28	17:45:00
September	-0.362	10	09:15:00
October	-0.361	14	12:45:00
November	-0.469	14	22:00:00
December	-0.5	18	17:00:00

Exteme Maxima	Value	Day	Time
January	5.085	13	00:30:00
February	5.371	9	23:30:00
March	4.913	29	00:45:00
April	4.896	11	00:00:00
May	4.782	26	00:00:00
June	4.87	26	14:00:00
July	5.004	23	12:15:00
August	4.988	20	11:15:00
September	5.041	20	12:15:00
October	5.031	7	12:45:00
November	5.171	4	11:45:00
December	5.105	6	01:30:00

Extreme minima	Value	Day	Time
January	0.509	13	18:30:00
February	0.266	11	18:00:00
March	0.3	11	17:00:00
April	0.657	8	16:00:00
May	0.633	27	06:15:00
June	0.503	25	06:15:00
July	0.426	25	06:45:00
August	0.328	22	05:45:00
September	0.355	21	05:45:00
October	0.526	18	04:00:00
November	0.979	2	16:00:00
December	0.676	18	17:45:00

Mean sea level	No days	MSL
January	31	2.904
February	28	2.836
March	31	2.818
April	30	2.841
May	31	2.809
June	30	2.877
July	31	2.923
August	31	2.887
September	30	2.846
October	31	2.936
November	30	3.091
December	31	3.015
	Sum	Avg
	365	2.899

## Sheerness Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 179: TGI on site to replace the compressor and carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	106	032-218,254-259,283-285,287-301,309-318,322-326,328-365

Statistics:

Surge maxima	Value	Day	Time
January	0.697	5	10:00:00
February	0.419	2	00:00:00
March			
April			
May			
June			
July			
August	0.46	29	03:15:00
September	1.199	9	10:45:00
October	0.983	4	09:45:00
November	0.835	23	14:30:00
December			

Surge minima	Value	Day	Time
January	-0.66	11	21:45:00
February	-0.251	3	19:45:00
March			
April			
May			
June			
July			
August	-0.508	31	05:15:00
September	-0.706	3	07:15:00
October	-0.594	3	12:15:00
November	-0.907	18	14:00:00
December			

Exteme Maxima	Value	Day	Time
January	6.12	13	01:30:00
February	5.521	2	04:15:00
March			
April			
May			
June			
July			
August	6.207	22	01:30:00
September	6.181	20	13:15:00
October	6.261	7	14:00:00
November	6.103	4	13:00:00
December			

Extreme minima	Value	Day	Time
January	0.105	12	07:45:00
February	1.032	2	10:15:00
March			
April			
May			
June			
July			
August	0.188	23	21:15:00
September	0.338	19	19:15:00
October	0.498	6	20:00:00
November	0.362	3	19:15:00
December			

Mean sea level	No days	MSL
January	11	3.032
February	0	
March	0	
April	0	
May	0	
June	0	
July	0	
August	25	3.05
September	23	3.114
October	12	3.157
November	6	3.057
December	0	
	Sum	Avg
	77	3.082

## St. Mary's (Isles of Scilly) Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 185: TGI on site to carry out general maintenance.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
100	15 minutes	None	012-015,017-185,228-294,326

Statistics:

Surge maxima	Value	Day	Time
January	0.18	16	21:45:00
February			
March			
April			
May			
June			
July	0.303	21	23:15:00
August	0.148	4	01:15:00
September			
October	0.314	21	17:15:00
November	0.598	14	07:15:00
December	0.493	30	11:30:00

Surge minima	Value	Day	Time
January	-0.221	8	14:15:00
February			
March			
April			
May			
June			
July	-0.176	18	00:30:00
August	-0.134	11	11:45:00
September			
October	-0.145	31	18:30:00
November	-0.242	8	12:30:00
December	-0.193	18	23:45:00

Exteme Maxima	Value	Day	Time
January	5.957	12	05:15:00
February			
March			
April			
May			
June			
July	6.063	23	17:30:00
August	5.449	8	18:00:00
September			
October	5.668	21	18:15:00
November	5.887	16	04:00:00
December	5.931	6	07:15:00

Extreme minima	Value	Day	Time
January	0.525	12	11:45:00
February			
March			
April			
May			
June			
July	0.329	25	01:00:00
August	0.952	9	00:45:00
September			
October	1.233	31	21:15:00
November	0.99	2	22:30:00
December	0.867	3	11:15:00

Mean sea level	No days	MSL
January	10	3.115
February	0	
March	0	
April	0	
May	0	
June	0	
July	27	3.207
August	15	3.15
September	0	
October	10	3.311
November	28	3.375
December	31	3.376
	Sum	Avg
	121	3.256



## Stornoway Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 2.71m below Ordnance Datum Local (ODL)  
TGZ = 6.368m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: There were no visits to site in 2009.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
100	15 minutes	None	None

Statistics:

Surge maxima	Value	Day	Time
January	0.909	18	03:15:00
February	0.165	25	15:45:00
March	0.491	8	05:15:00
April	0.443	7	16:15:00
May	0.591	7	14:45:00
June	0.352	18	09:45:00
July	0.354	28	18:45:00
August	0.385	1	10:30:00
September	0.632	8	17:00:00
October	0.485	3	07:45:00
November	0.818	25	07:00:00
December	0.717	6	23:30:00

Surge minima	Value	Day	Time
January	-0.28	2	03:00:00
February	-0.304	7	04:45:00
March	-0.294	28	03:45:00
April	-0.167	16	12:45:00
May	-0.157	31	19:00:00
June	-0.177	1	02:15:00
July	-0.093	25	06:15:00
August	-0.101	13	22:00:00
September	-0.256	16	17:00:00
October	-0.337	16	01:00:01
November	-0.364	9	00:45:01
December	-0.379	31	02:45:00

Exteme Maxima	Value	Day	Time
January	5.665	12	07:30:00
February	5.293	10	07:00:00
March	5.369	12	07:30:00
April	5.068	10	07:00:00
May	4.957	8	05:45:00
June	4.976	24	19:45:00
July	5.332	23	19:30:00
August	5.487	21	19:30:00
September	5.419	19	18:45:00
October	5.131	20	07:30:01
November	5.233	3	19:00:01
December	5.354	6	09:30:00

Extreme minima	Value	Day	Time
January	0.477	13	14:45:00
February	0.073	11	14:30:00
March	0.261	28	14:15:00
April	0.552	25	13:00:00
May	0.764	25	13:15:00
June	0.466	25	02:45:00
July	0.272	25	03:15:00
August	0.282	22	02:00:00
September	0.275	20	01:45:00
October	0.411	16	23:45:01
November	0.928	5	14:30:01
December	0.838	31	12:45:00

Mean sea level	No days	MSL
January	31	3.107
February	28	2.831
March	31	2.879
April	30	2.86
May	31	2.881
June	30	2.829
July	31	2.952
August	31	3.007
September	30	2.938
October	31	3.008
November	30	3.166
December	31	3.033
	Sum	Avg
	365	2.958

## Tobermory Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 2.39m below Ordnance Datum Newlyn (ODN)  
TGZ = Chart Datum = 6.856m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: There were no visits to site in 2009.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	112-116,322	None

Statistics:

Surge maxima	Value	Day	Time
January	1.358	17	21:00:00
February	0.14	28	17:15:00
March	0.622	7	22:30:00
April	0.369	9	15:45:00
May	0.621	7	23:00:00
June	0.356	18	17:00:00
July	0.429	12	10:00:00
August	0.471	27	21:45:00
September	0.551	8	12:00:00
October	0.587	24	22:15:00
November	1.071	25	07:15:00
December	0.812	6	15:30:00

Surge minima	Value	Day	Time
January	-0.27	5	11:15:00
February	-0.365	7	11:15:00
March	-0.421	28	06:45:00
April	-0.173	21	21:45:00
May	-0.175	31	00:30:00
June	-0.196	1	01:30:00
July	-0.161	17	13:00:00
August	-0.152	13	22:15:00
September	-0.297	15	23:30:00
October	-0.341	15	23:30:00
November	-0.424	8	16:30:00
December	-0.479	31	03:30:00

Exteme Maxima	Value	Day	Time
January	5.243	12	06:15:00
February	4.898	10	06:15:00
March	5.027	14	07:30:00
April	4.861	9	18:00:00
May	4.766	8	05:00:00
June	4.631	24	19:00:00
July	5.055	23	18:45:00
August	5.169	21	18:30:00
September	5.023	21	19:15:00
October	4.921	20	06:45:00
November	4.991	19	06:45:00
December	5.186	6	08:15:00

Extreme minima	Value	Day	Time
January	0.474	14	02:00:00
February	0.123	12	01:30:00
March	0.277	28	13:15:00
April	0.658	8	23:30:00
May	0.709	25	12:30:00
June	0.572	25	13:45:00
July	0.368	25	14:15:00
August	0.255	22	13:15:00
September	0.355	20	12:45:00
October	0.565	18	11:45:00
November	0.961	5	13:30:00
December	0.813	4	01:00:00

Mean sea level	No days	MSL
January	31	2.902
February	28	2.632
March	31	2.684
April	23	2.685
May	31	2.707
June	30	2.663
July	31	2.776
August	31	2.824
September	30	2.728
October	31	2.821
November	30	2.988
December	31	2.844
	Sum	Avg
	358	2.771

## Ullapool Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 2.75m below Ordnance Datum Newlyn (ODN)  
TGZ = 7.155m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: There were no visits to site in 2009.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
100	15 minutes	None	None

Statistics:

Surge maxima	Value	Day	Time
January	1.021	18	03:30:00
February	0.181	25	16:30:00
March	0.554	8	05:15:00
April	0.389	7	15:45:00
May	0.673	7	08:45:00
June	0.365	18	10:00:00
July	0.356	12	17:30:00
August	0.386	15	20:15:00
September	0.749	8	16:30:00
October	0.593	3	08:45:00
November	0.878	25	11:45:00
December	0.693	6	18:00:00

Surge minima	Value	Day	Time
January	-0.348	2	02:30:00
February	-0.401	7	12:00:00
March	-0.354	28	04:00:00
April	-0.231	16	05:45:00
May	-0.214	11	23:30:00
June	-0.206	1	02:15:00
July	-0.142	17	23:45:00
August	-0.167	13	22:15:00
September	-0.302	16	16:45:00
October	-0.416	16	00:30:00
November	-0.466	9	01:00:00
December	-0.494	31	04:00:00

Exteme Maxima	Value	Day	Time
January	5.947	12	07:15:00
February	5.578	10	07:15:00
March	5.698	12	07:30:00
April	5.405	9	19:00:00
May	5.373	8	06:15:00
June	5.25	24	20:00:00
July	5.623	23	19:45:00
August	5.805	21	19:30:00
September	5.711	19	19:15:00
October	5.475	20	07:45:00
November	5.547	3	19:00:00
December	5.682	6	09:30:00

Extreme minima	Value	Day	Time
January	0.418	14	15:30:00
February	0.07	11	14:30:00
March	0.23	28	14:00:00
April	0.536	25	13:00:00
May	0.765	25	13:15:00
June	0.465	25	02:45:00
July	0.281	25	03:15:00
August	0.294	22	02:15:00
September	0.294	20	01:45:00
October	0.453	17	00:15:00
November	0.904	5	14:15:00
December	0.808	31	12:45:00

Mean sea level	No days	MSL
January	31	3.272
February	28	2.99
March	31	3.061
April	30	3.017
May	31	3.047
June	30	2.987
July	31	3.104
August	31	3.172
September	30	3.112
October	31	3.175
November	30	3.331
December	31	3.186
	Sum	Avg
	365	3.121

## Weymouth Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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 Gauge Hut	SY 6837 7884	Bolt concrete SW corner of building adjacent to Tide

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

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: Day 190: TGI on site to carry out general maintenance and  
purge system  
Day 252: TGI on site to replace compressor and carry out  
general maintenance

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	189-190,266,287	001-008,023-031,034- 036,040-041,140- 155,182,193-203,246- 273,275-279,281-285,305- 330,348-354

Statistics:

Surge maxima	Value	Day	Time
January	0.777	19	05:45:00
February	0.415	5	07:00:00
March	0.426	3	19:30:00
April	0.319	8	01:00:00
May	0.257	17	11:30:00
June	0.234	6	18:30:00
July	0.158	23	13:00:00
August	0.168	26	12:30:00
September	0.242	2	18:15:00
October	0.258	7	13:45:00
November	0.583	29	01:45:00
December	0.483	6	04:45:00

Surge minima	Value	Day	Time
January	-0.275	8	18:15:00
February	-0.355	25	12:00:00
March	-0.381	18	07:15:00
April	-0.342	21	20:45:00
May	-0.343	5	00:45:00
June	-0.222	22	12:15:00
July	-0.182	25	19:00:00
August	-0.281	28	19:15:00
September	-0.234	30	08:15:00
October	-0.392	16	02:00:00
November	-0.172	30	18:45:00
December	-0.345	13	01:30:00

Exteme Maxima	Value	Day	Time
January	2.487	13	08:15:00
February	2.477	11	08:00:00
March	2.344	10	06:30:00
April	2.346	27	08:00:00
May	2.089	10	19:45:00
June	2.4	25	21:15:00
July	2.524	23	20:00:00
August	2.511	22	20:30:00
September	2.221	2	18:00:00
October	2.524	20	08:15:00
November	2.406	4	19:30:00
December	2.518	5	08:30:00

Extreme minima	Value	Day	Time
January	-0.068	13	16:30:00
February	-0.252	11	16:15:00
March	-0.211	12	15:45:00
April	0.066	8	14:00:00
May	0.156	7	10:15:00
June	-0.04	24	03:30:00
July	-0.191	25	05:00:00
August	-0.233	22	04:00:00
September	0.561	1	22:00:00
October	0.007	18	02:15:00
November	0.447	30	21:45:00
December	0.251	3	15:15:00

Mean sea level	No days	MSL
January	13	1.159
February	19	0.964
March	31	1.014
April	30	1.057
May	19	1.032
June	26	1.102
July	16	1.121
August	31	1.092
September	1	1.149
October	19	1.15
November	4	1.386
December	23	1.294
	Sum	Avg
	232	1.127



## Whitby Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 3.00m below Ordnance Datum Newlyn (ODN)  
TGZ = 9.105m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 069:	TGI on site to carry out general maintenance and memory upgrade
	Day 232:	TGI on site to replace the compressor and carry out general maintenance

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
100	15 minutes	None	031-035,037-038,069,105-113,116-118,135-136,138-140,145-146,155-158,160-162,165,171-173,175-176,185-218,220-223,288-299,322-329,332-338,351-356,364-365

Statistics:

Surge maxima	Value	Day	Time
January	1.137	18	16:00:00
February	0.338	22	12:45:00
March	0.617	23	22:00:00
April	0.351	8	00:00:00
May	0.554	7	22:45:00
June	0.414	18	07:30:00
July	0.218	4	09:45:00
August	0.358	28	21:15:00
September	0.858	9	02:00:00
October	0.654	3	23:00:00
November	0.565	26	07:00:00
December	0.479	7	09:45:00

Surge minima	Value	Day	Time
January	-0.514	22	11:00:00
February	-0.174	12	14:30:00
March	-0.273	18	01:00:00
April	-0.18	20	23:00:00
May	-0.152	4	12:30:00
June	-0.119	1	01:00:00
July	0.003	2	13:15:00
August	-0.134	14	19:15:00
September	-0.285	8	14:15:00
October	-0.18	13	18:45:00
November	-0.285	9	05:45:00
December	-0.135	18	14:00:00

Exteme Maxima	Value	Day	Time
January	6.353	12	16:45:00
February	6.004	10	16:30:00
March	6.077	12	16:45:00
April	5.831	10	16:30:00
May	5.686	7	14:45:00
June	5.807	26	06:15:00
July	4.84	4	01:30:00
August	6.112	22	05:00:00
September	6.293	20	04:15:00
October	6.091	4	03:30:00
November	5.898	4	16:30:00
December	5.782	7	19:45:00

Extreme minima	Value	Day	Time
January	0.541	15	01:00:00
February	0.532	10	23:00:00
March	0.397	11	22:45:00
April	0.737	9	22:00:00
May	0.902	27	12:00:00
June	0.817	26	12:45:00
July	1.862	1	17:15:00
August	0.386	23	12:00:00
September	0.484	19	10:15:00
October	0.979	5	10:30:00
November	1.137	3	10:00:00
December	0.998	4	23:30:00

Mean sea level	No days	MSL
January	29	3.468
February	22	3.402
March	30	3.386
April	15	3.363
May	20	3.372
June	10	3.375
July	2	3.385
August	20	3.475
September	30	3.487
October	18	3.512
November	17	3.508
December	16	3.598
	Sum	Avg
	229	3.444

## Wick Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 1.71m below Ordnance Datum (ODN)  
TGZ = 5.084m below TGBM

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site: There were no visits to site in 2009.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
99	15 minutes	108	None

Statistics:

Surge maxima	Value	Day	Time
January	0.974	18	11:15:00
February	0.169	26	08:45:00
March	0.527	8	19:30:00
April	0.353	7	22:00:00
May	0.722	7	19:00:00
June	0.318	18	04:30:00
July	0.298	29	13:30:00
August	0.288	26	00:00:00
September	0.696	8	22:00:00
October	0.479	3	10:30:00
November	0.694	25	07:45:00
December	0.591	7	10:00:00

Surge minima	Value	Day	Time
January	-0.35	2	07:00:00
February	-0.337	7	09:45:00
March	-0.291	17	17:45:00
April	-0.196	17	08:00:00
May	-0.23	12	06:30:00
June	-0.211	1	04:30:00
July	-0.139	25	16:30:00
August	-0.128	13	17:30:00
September	-0.274	13	12:15:00
October	-0.319	17	03:00:00
November	-0.389	8	22:15:00
December	-0.404	17	18:00:00

Exteme Maxima	Value	Day	Time
January	4.247	12	11:45:00
February	3.745	10	11:45:00
March	3.91	12	12:00:00
April	3.694	10	11:30:00
May	3.693	7	22:15:00
June	3.5	26	01:15:00
July	3.806	22	23:30:00
August	3.965	20	23:15:00
September	3.956	19	23:30:00
October	3.766	7	00:30:00
November	3.949	19	12:15:00
December	3.926	7	14:45:00

Extreme minima	Value	Day	Time
January	0.249	14	19:45:00
February	0.002	11	18:30:00
March	0.234	11	17:15:00
April	0.415	25	17:15:00
May	0.419	28	07:45:00
June	0.139	25	06:45:00
July	0.104	25	07:15:00
August	0.184	22	06:15:00
September	0.253	18	04:30:00
October	0.196	17	04:00:00
November	0.666	8	21:30:00
December	0.466	31	16:45:00

Mean sea level	No days	MSL
January	31	2.196
February	28	1.975
March	31	2.025
April	30	1.963
May	31	2.002
June	30	1.95
July	31	2.072
August	31	2.122
September	30	2.097
October	31	2.121
November	30	2.289
December	31	2.145
	Sum	Avg
	365	2.08

## Workington Tide Gauge

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

### Benchmarks and Benchmark relationships:

Benchmark	Grid Reference	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

TGZ = Admiralty Chart Datum (ACD)  
TGZ = 4.20m below Ordnance Datum Newlyn (ODN)  
TGZ = 11.59m below Aux1

Datum information: All data are to Admiralty Chart Datum (ACD).

Levelling information: No levelling was carried out in 2009.

TGI visits to site:	Day 071:	TGI on site to clear blockage in system.
	Day 112:	TGI on site to investigate a communications fault.
	Day 160:	TGI on site to carry out general maintenance and install new flow meter.
	Day 254:	TGI on site to investigate an electrical fault.
	Day 331:	TGI on site to fit GSM modem.

### Data quality:

CI%	Sample Interval	Missing Data	Suspect Data
100	15 minutes	None	001-071,112-160,220-222

Statistics:

Surge maxima	Value	Day	Time
January			
February			
March	0.43	26	08:45:00
April	0.768	8	04:30:00
May			
June	0.44	17	11:30:00
July	0.605	22	08:15:00
August	0.598	26	11:15:00
September	0.44	8	09:00:00
October	0.708	24	19:30:00
November	1.213	25	11:15:00
December	0.706	6	12:00:00

Surge minima	Value	Day	Time
January			
February			
March	-0.571	28	10:45:00
April	-0.367	22	01:15:00
May			
June	-0.272	23	13:15:00
July	-0.34	17	08:15:00
August	-0.283	28	21:00:00
September	-0.503	15	23:45:00
October	-0.439	11	23:15:00
November	-0.721	30	00:30:00
December	-0.622	18	02:45:00

Exteme Maxima	Value	Day	Time
January			
February			
March	8.658	13	12:45:00
April	8.612	9	11:15:00
May			
June	8.478	26	01:30:00
July	8.937	24	00:30:00
August	9.041	22	00:00:00
September	8.861	21	00:30:00
October	8.736	20	00:00:00
November	8.814	19	12:30:00
December	8.962	6	14:00:00

Extreme minima	Value	Day	Time
January			
February			
March	0.362	12	18:45:00
April	0.842	8	17:00:00
May			
June	0.532	25	07:15:00
July	0.318	25	08:00:00
August	0.314	22	06:45:00
September	0.268	20	06:30:00
October	0.574	17	04:45:00
November	1.107	5	19:15:00
December	1.008	4	19:00:00

Mean sea level	No days	MSL
January	0	
February	0	
March	19	4.381
April	21	4.432
May	0	
June	21	4.446
July	31	4.555
August	27	4.601
September	30	4.454
October	31	4.576
November	30	4.79
December	31	4.604
	Sum	Avg
	241	4.538

## Instrument documentation

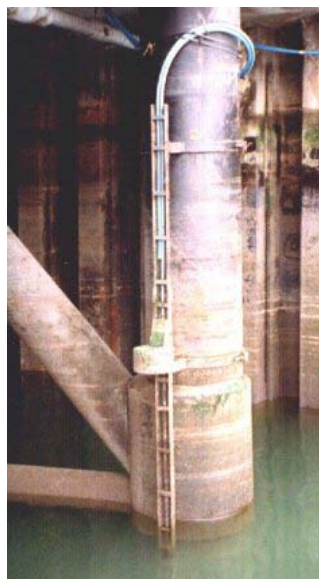
### Bubbler tide gauge

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 may be recorded. The pressure points which you can see mounted underwater in the photograph are similar in appearance to 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 air line equals the pressure exerted by the column of water above it, then the excess air is released as bubbles through the copper nozzle. This means that 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. The reason for this is that when the measuring point is exposed as in the photograph below it can be accurately levelled 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 copper nozzle, transducer measuring port and connecting tube are filled with oil so the pressure is transmitted to the crystal element via the oil, thus keeping the transducer components free from the effects of the saltwater.



## Munro float gauge

The Munro gauge measures sea level by means of 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 and another drum contains a counter balance wire. The drum is geared to a slotted tape attached to a pen carriage which traces the tide curve on the chart during the rise and fall of the tide. A precision potentiometer is attached to the gauge to provide an input to the data logger.



## Wellhead float gauge

The Wellhead gauge measures the sea level by means of a float in a stilling well. The float is usually of a smaller diameter than that used on a Munro gauge (about 45cm diameter), and has a counterweight attached to a smaller diameter pulley than that of the float so it is not immersed in the sea when the float rises. The Wellhead unit does not produce a chart but does give a readout of the height. It is interfaced to the data logger via a precision potentiometer.





## Data Processing

The data are collected on demand each week at the Proudman Oceanographic Laboratory. The weekly files are then screened using our in-house visualisation package, Edserplo. Suspect values are flagged and short gaps are interpolated where the accuracy is deemed not to be affected.

The weekly files are then concatenated into monthly files, with the residual added. These are then edited so that all values fall on the quarter hour and gaps are filled in with null values and marked with an 'N' flag. The files are placed on the web for users to download. Statistics are produced monthly, again using Edserplo.

Finally, the monthly files are concatenated into yearly files and the metadata for the yearly files are then banked in a database.

## Calculating Statistics in Edserplo

There are essentially four types of summary information determined by Edserplo:

- 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 POL’s Applications Group (as defined at the time of the calculation) for the ports of 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 03B 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.

## Aberdeen Tide Gauge

Latitude: 57° 08' 38.6" N

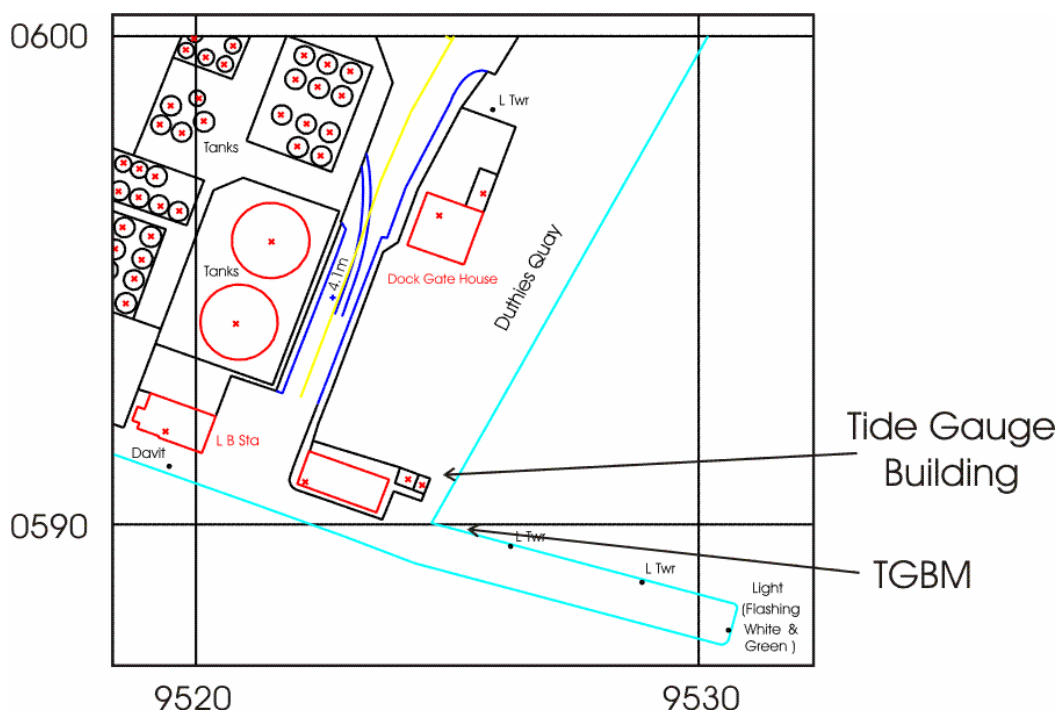
Longitude: 02° 04' 38.5" W

Grid Reference: NJ 9525 0591

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

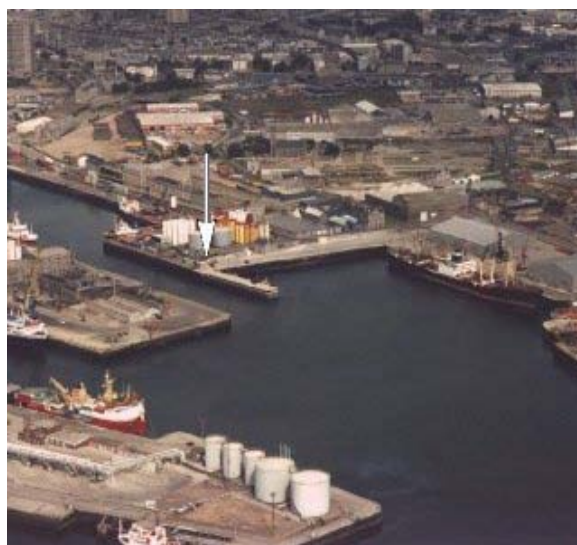
The tide gauge building is located on Waterloo Quay and the pressure points are located in the South West corner of Telford Dock.



©Crown copyright. All rights reserved NERC 100017897 2009



Tide gauge location



Aerial view of site

## Avonmouth Tide Gauge

Latitude: 51° 30' 27.6" N

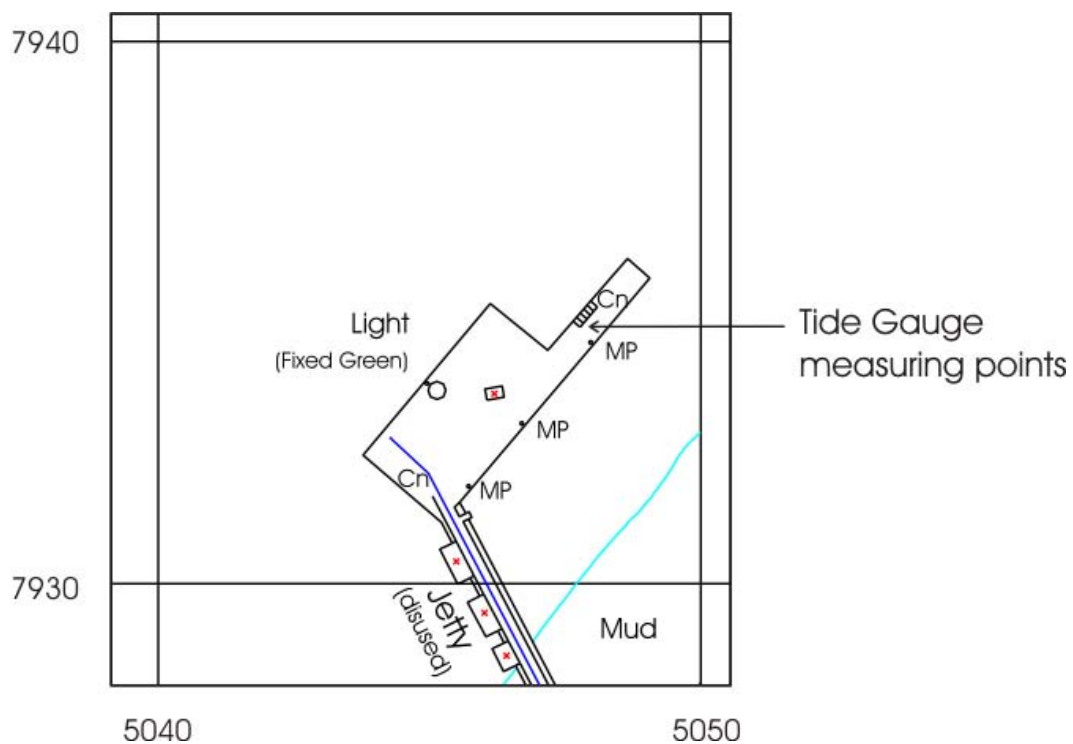
Longitude: 02° 42' 45.9" W

Grid Reference: ST 5063 7899

Instrument type: Data acquisition system with dual underwater pressure transducers.

Site of Gauge:

The tide gauge building is located on land between the disused oil jetty and the fuel storage depot, with the measuring points being located at the seaward end of the jetty.



©Crown copyright. All rights reserved NERC 100017897 2009



## Bangor Tide Gauge

Latitude: 54° 39' 53.1" N

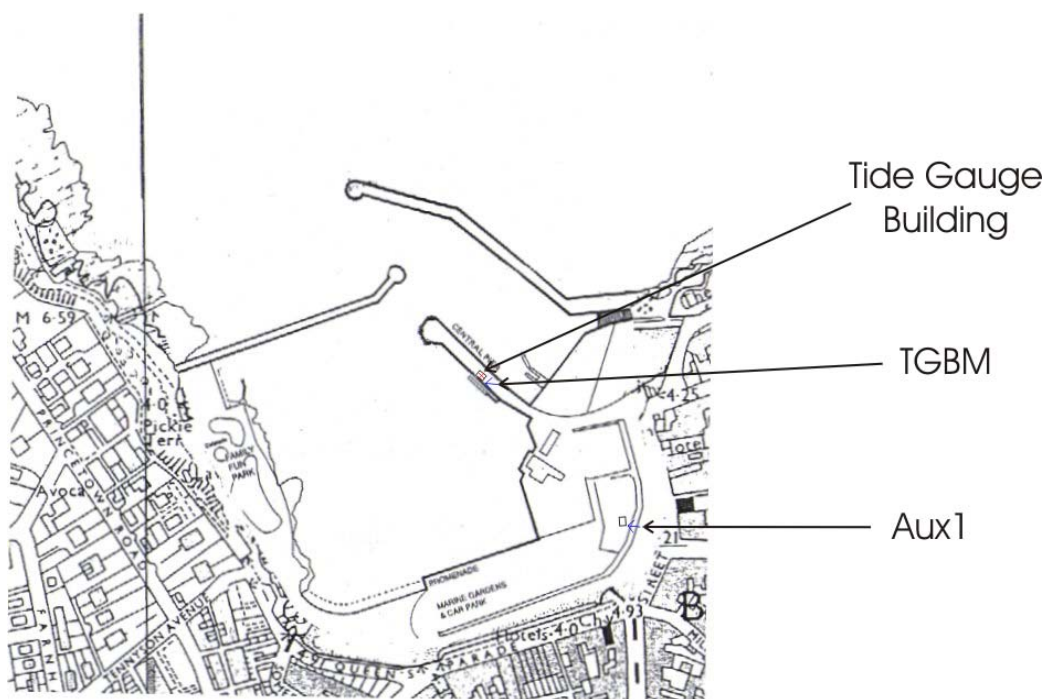
Longitude: 05° 40' 10.1" W

Grid Reference: NW 6340 3620

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building and pressure points are located on Central Pier at Bangor Marina. The pressure points are on the seaward side of the open pier directly beneath the tide gauge building.



©Ordnance Survey of Northern Ireland 2009



## Barmouth Tide Gauge

Latitude: 52° 43' 09.6" N

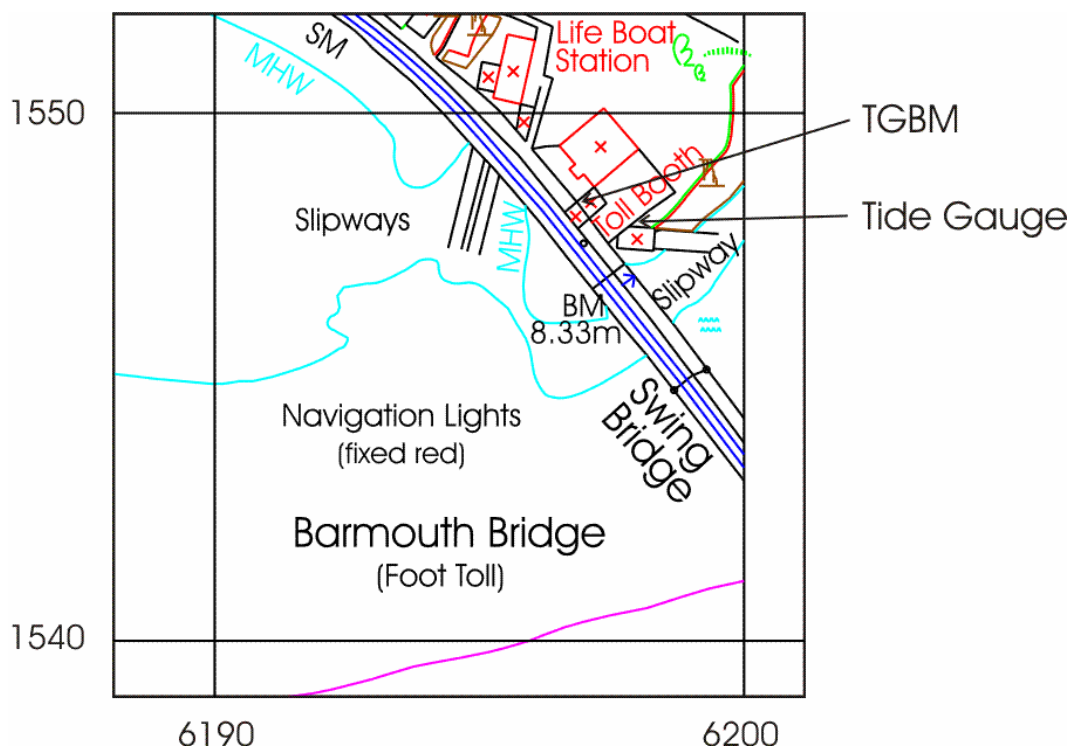
Longitude: 04° 02' 42.1" W

Grid Reference: SH 6197 1548

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge cabinet is located in the toll booth on the north end of Barmouth railway bridge which crosses the river Mawddach. The pressure points are attached to the first leg of the railway bridge in the deep channel.



©Crown copyright. All rights reserved NERC 100017897 2009



## Bournemouth Tide Gauge

Latitude: 50° 42' 51.6" N

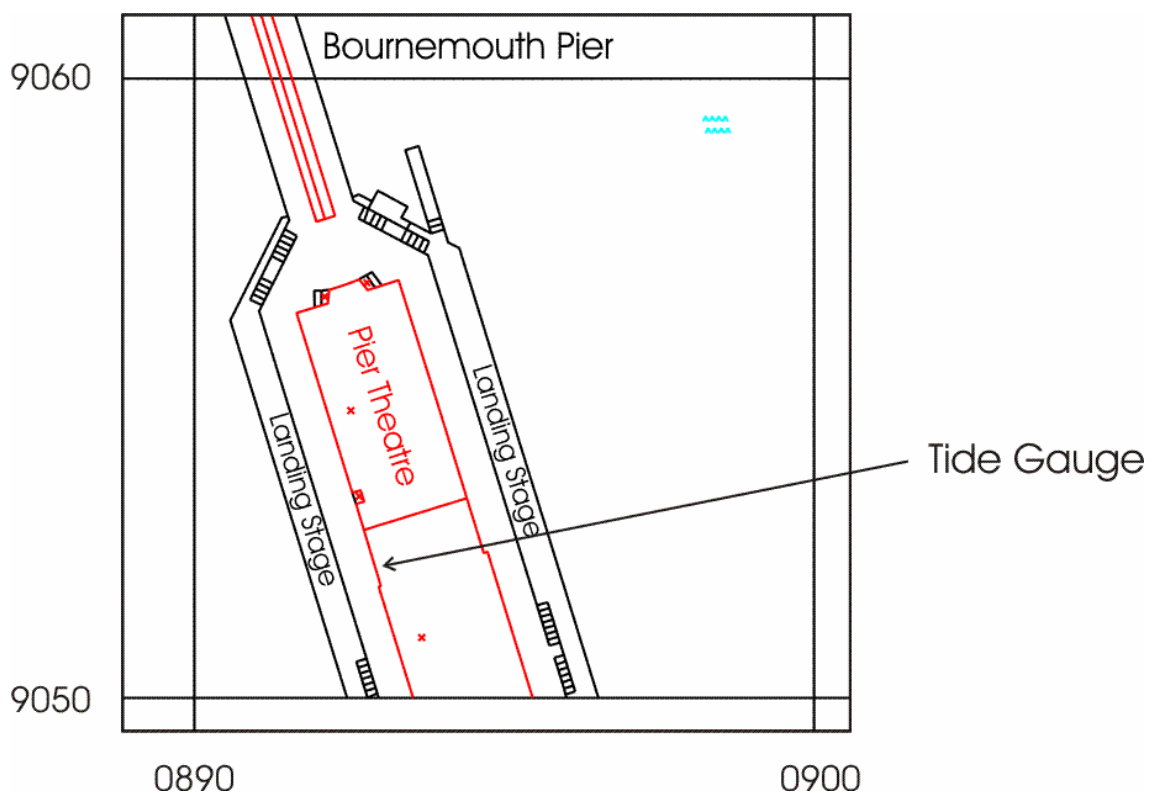
Longitude: 01° 52' 29.5" W

Grid Reference: SZ 0893 9053

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge equipment is located in the pier electrical room at the west side of the South Pier. The measuring points are mounted directly below on one of the pier legs.



©Crown copyright. All rights reserved NERC 100017897 2009



## Cromer Tide Gauge

Latitude: 52° 56' 03.7" N

Longitude: 01° 18' 05.9" E

Grid Reference: TG 2198 4254

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge cabinet is located within Cromer lifeboat station, with the pressure points attached to a leg of the lifeboat slipway.



©Crown copyright. All rights reserved NERC 100017897 2009



## Devonport Tide Gauge

Latitude: 50° 22' 06.2" N

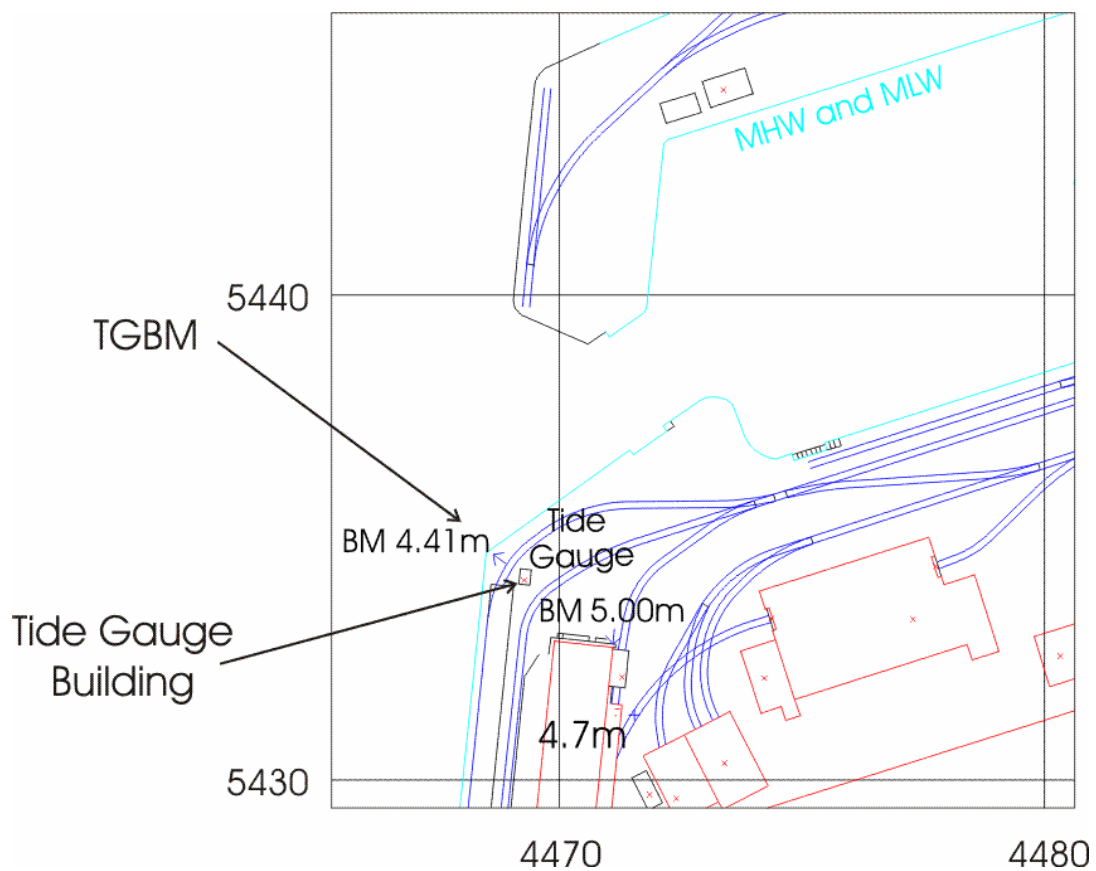
Longitude: 04° 11' 06.9" W

Grid Reference: SX 4469 5434

Instrument type: Data acquisition system with two full tide bubbler gauges installed.

Site of Gauge:

The tide gauge building is situated on No. 1 Jetty in Devonport Royal Naval base. The pressure points are attached to the stilling well beneath the building.



©Crown copyright. All rights reserved NERC 100017897 2009





## Dover Tide Gauge

Latitude: 51° 06' 51.8" N

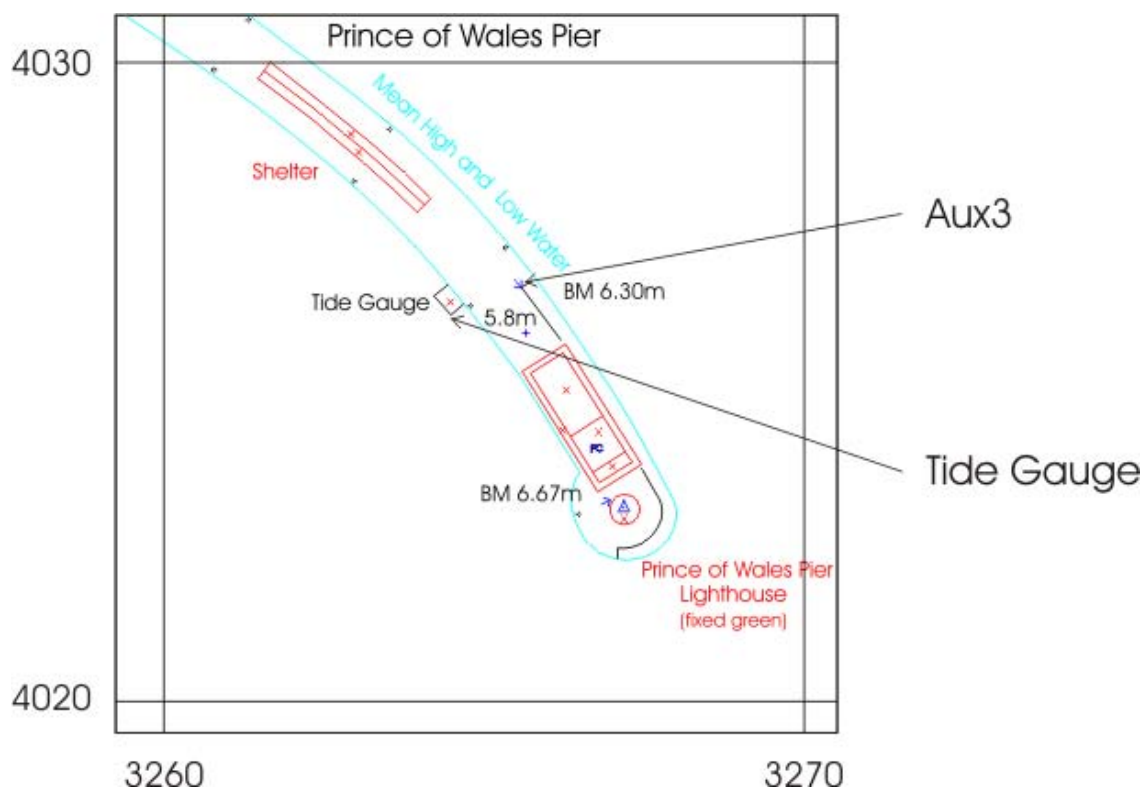
Longitude: 01° 19' 21.6" E

Grid Reference: TR 3265 4026

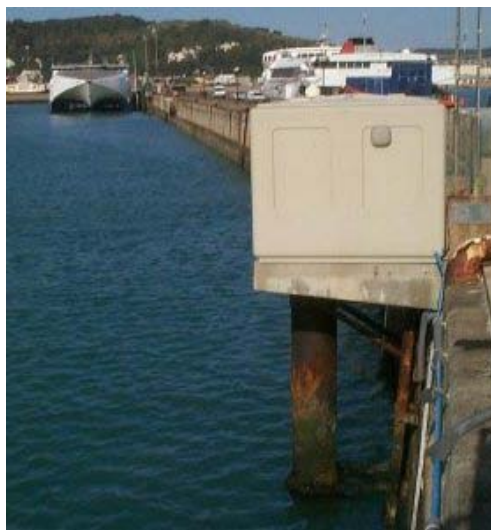
Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is at the seaward end of Prince of Wales Pier, Western Dock, just before the lighthouse. The pressure points are attached to the stilling well.



©Crown copyright. All rights reserved NERC 100017897 2009



## Felixstowe Tide Gauge

Latitude: 51° 57' 27.7" N

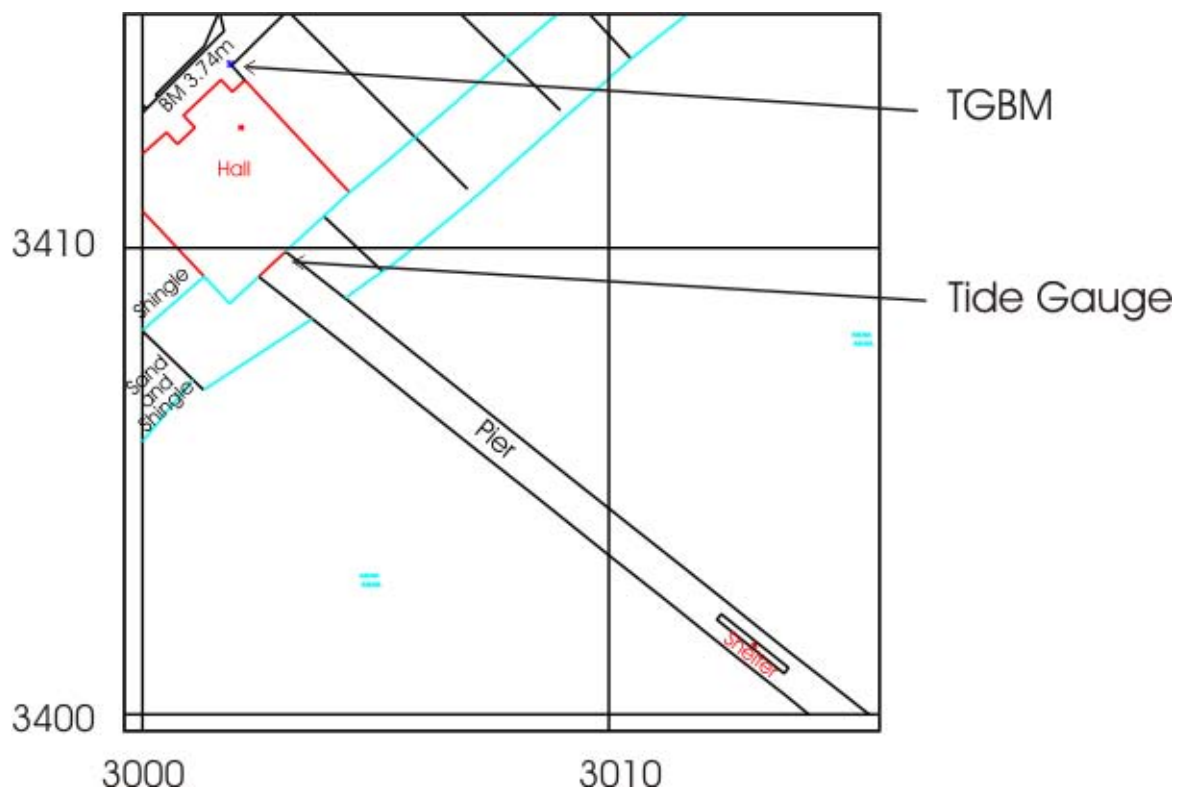
Longitude: 01° 20' 47.6" E

Grid Reference: TM 3003 3409

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building and pressure points are located on Felixstowe pier. The equipment is located on the landward end and the pressure points are located in deep water at the seaward end.



©Crown copyright. All rights reserved NERC 100017897 2009



## Fishguard Tide Gauge

Latitude: 52° 00' 47.6" N

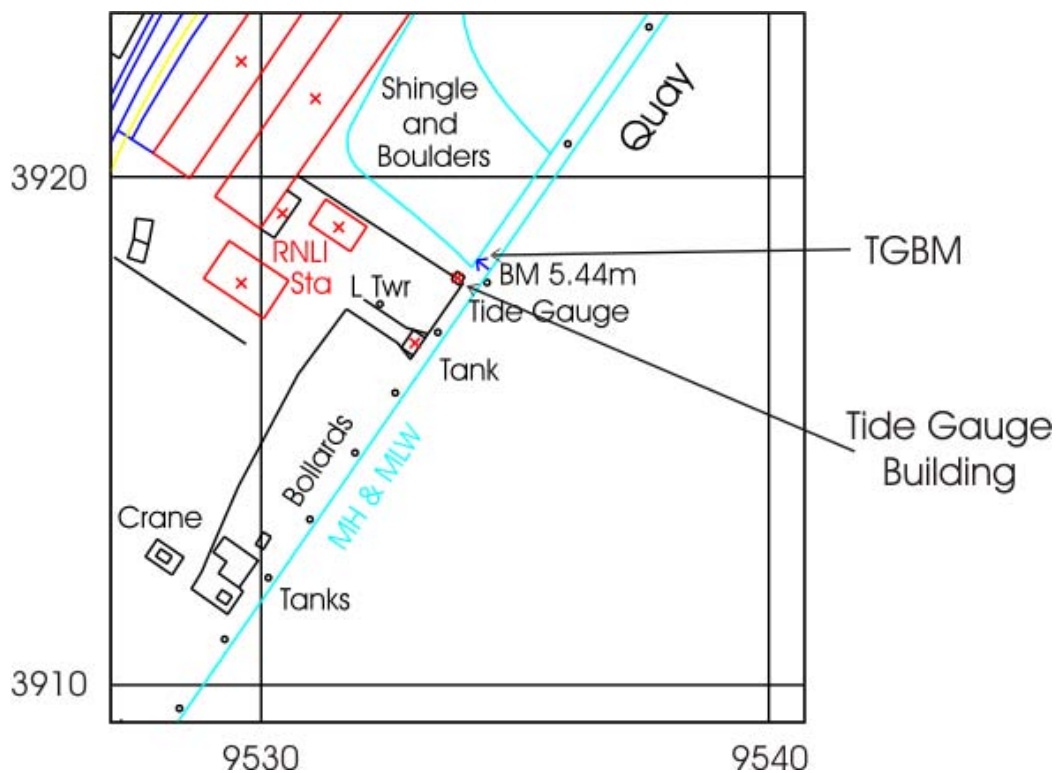
Longitude: 04° 59' 01.5" W

Grid Reference: SM 9534 3918

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is located on Fishguard Quay adjacent to the RNLI station, and the pressure points are located approximately 10m from the end of the quay.



©Crown copyright. All rights reserved NERC 100017897 2009



## Harwich Tide Gauge

Latitude: 51° 56' 52.8" N

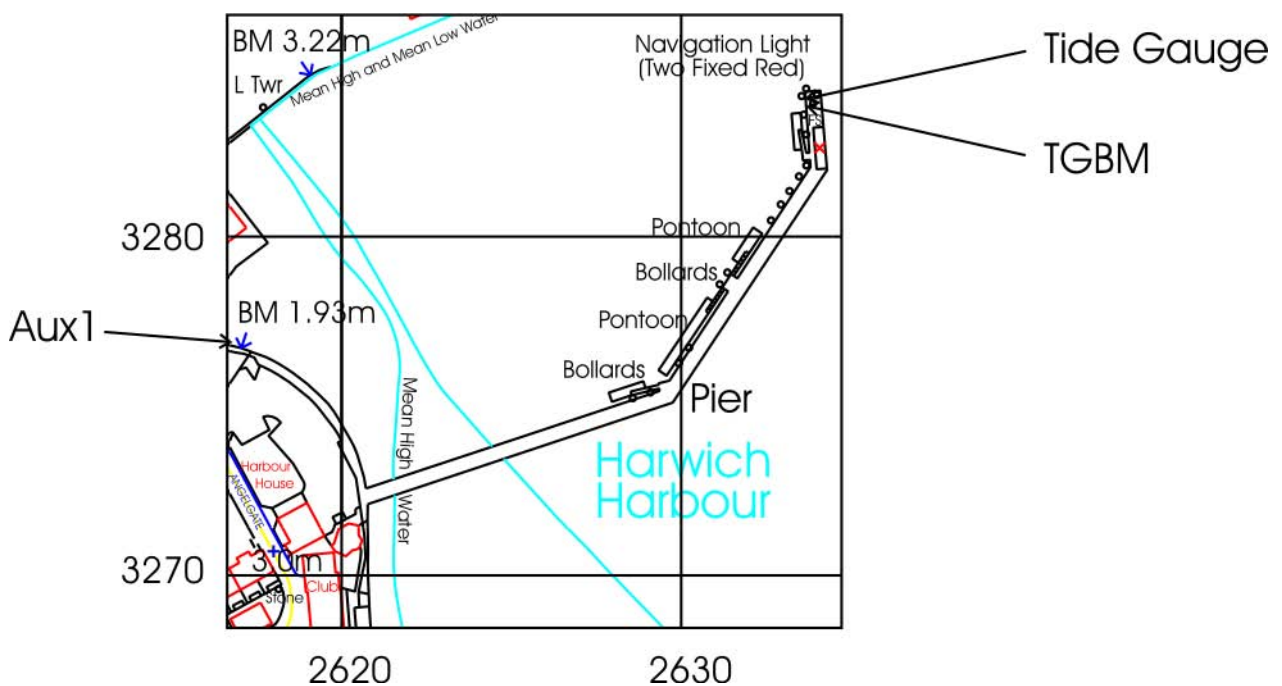
Longitude: 01° 17' 31.7" E

Grid Reference: TM 2634 3284

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge cabinet is located on the seaward end of Harwich Haven Authority jetty. The pressure points are directly below the cabinet.



©Crown copyright. All rights reserved NERC 100017897 2009



## Heysham Tide Gauge

Latitude: 54° 01' 54.6" N

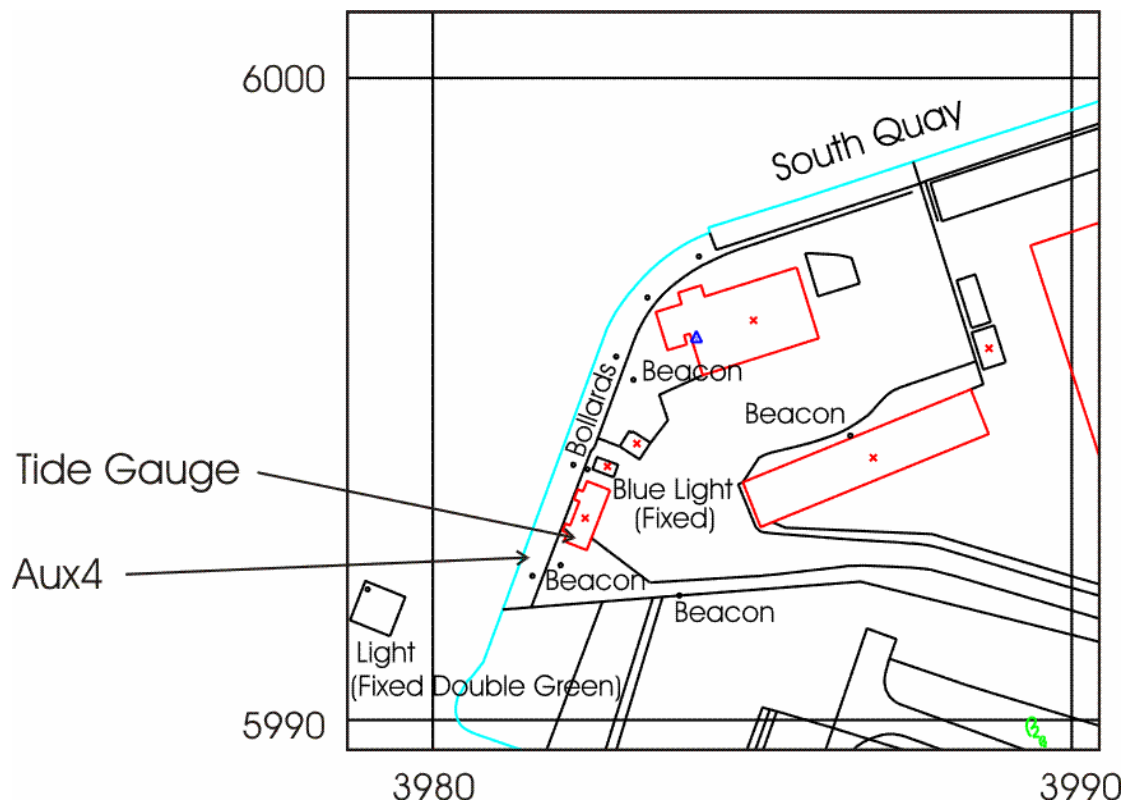
Longitude: 02° 55' 12.9" W

Grid Reference: SD 3982 5993

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is located on the south side of the entrance to Heysham harbour.



©Crown copyright. All rights reserved NERC 100017897 2009



## Hinkley Point Tide Gauge

Latitude: 51° 12' 38.2" N

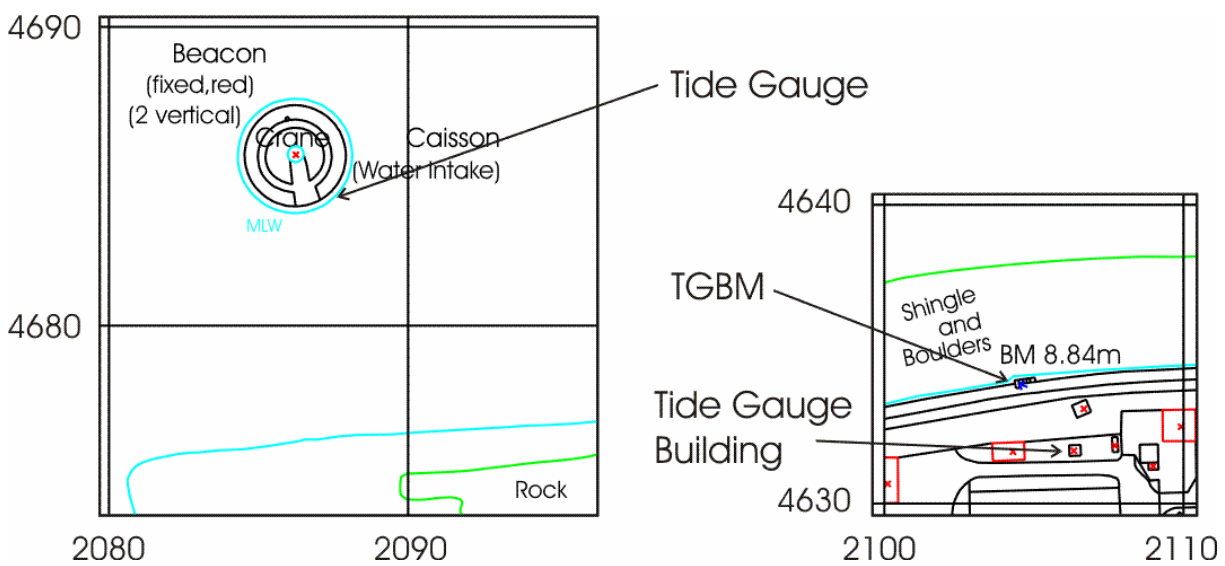
Longitude: 03° 07' 52.8" W

Grid Reference: ST 2107 4632

Instrument type: Dataring system with dual underwater pressure transducers.

Site of Gauge:

The tide gauge building is located in the Hinkley Point "A" station. The transducers are located in underwater vented chambers, suspended from a steel pole attached to the structure of the water intake tower, some 400m offshore.



©Crown copyright. All rights reserved NERC 100017897 2009



## Holyhead Tide Gauge

Latitude: 53° 18' 50.2" N

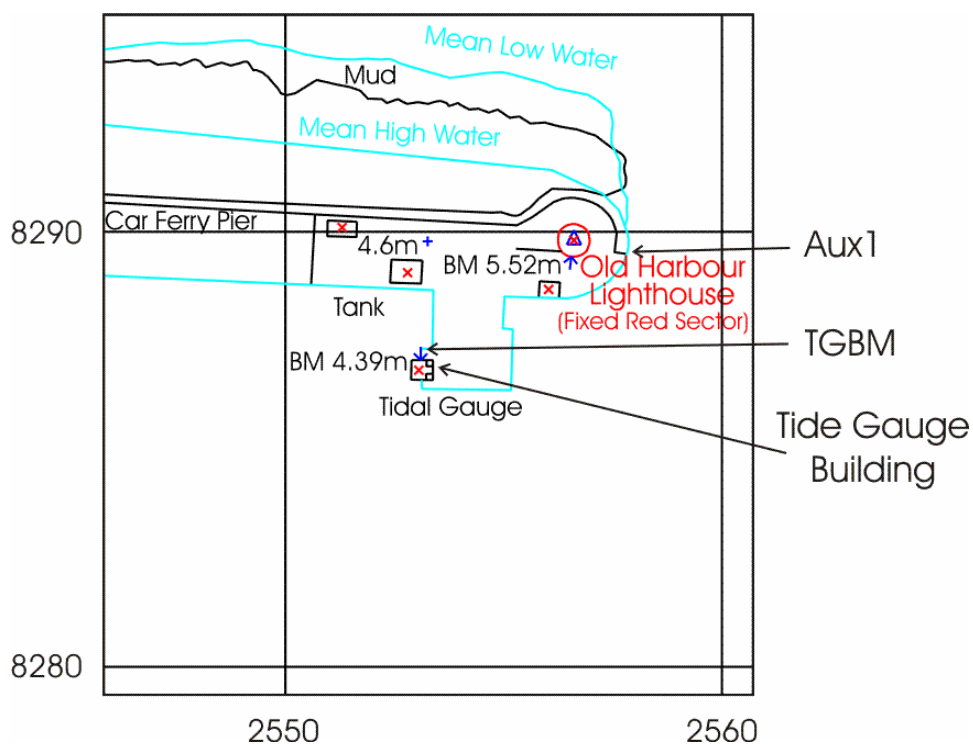
Longitude: 04° 37' 13.6" W

Grid Reference: SH 2553 8287

Instrument type: Data acquisition system with a full tide and a mid-tide bubbler gauge and a back-up Munro float gauge installed. Wind speed and wind direction are also recorded.

Site of Gauge:

The tide gauge building, pressure points and stilling well are situated on Salt Island jetty, close to the old harbour lighthouse.



©Crown copyright. All rights reserved NERC 100017897 2009



## Ifracombe Tide Gauge

Latitude: 51° 12' 40.1" N

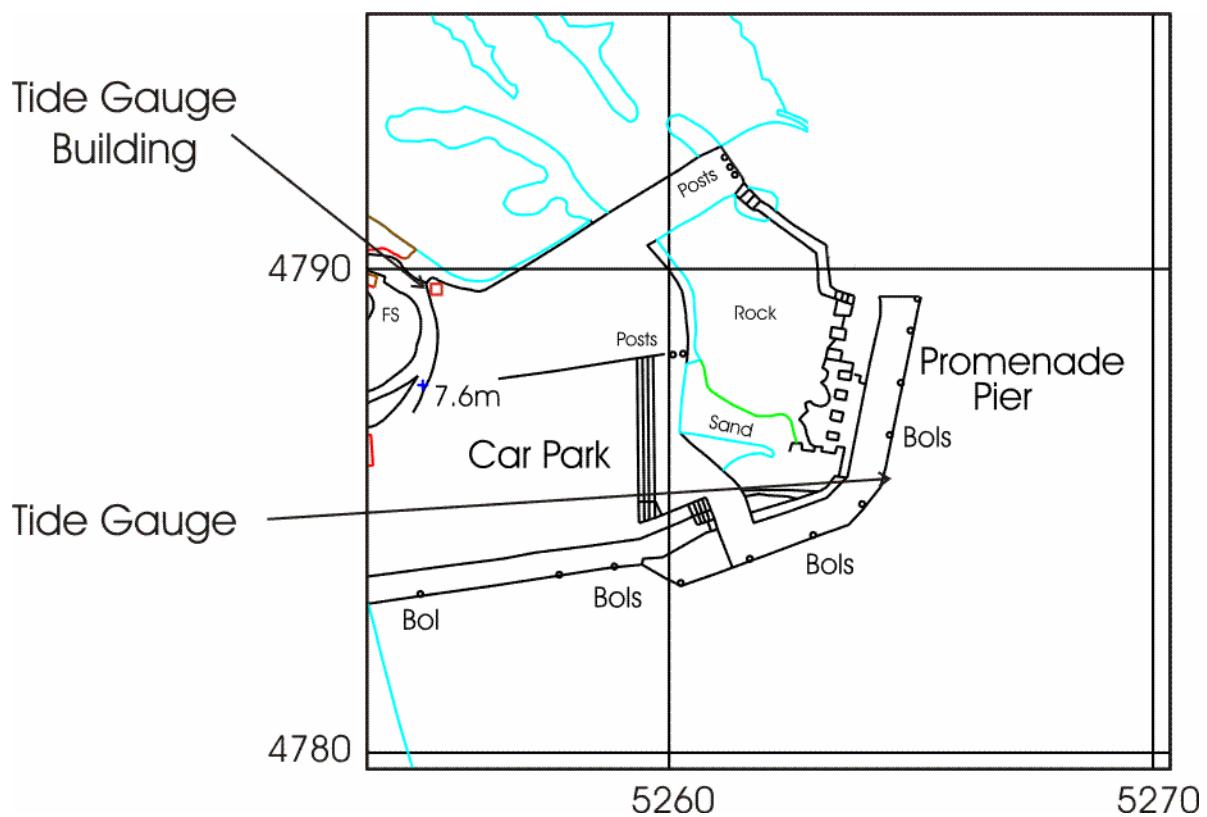
Longitude: 04° 06' 44.6" W

Grid Reference: SS 5255 4789

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is located in the north west corner of the car park, east of Lantern Hill. The pressure points are located on the seaward side of Ilfracombe pier at the harbour entrance.



©Crown copyright. All rights reserved NERC 100017897 2009





## Immingham Tide Gauge

Latitude: 53° 37' 48.8" N

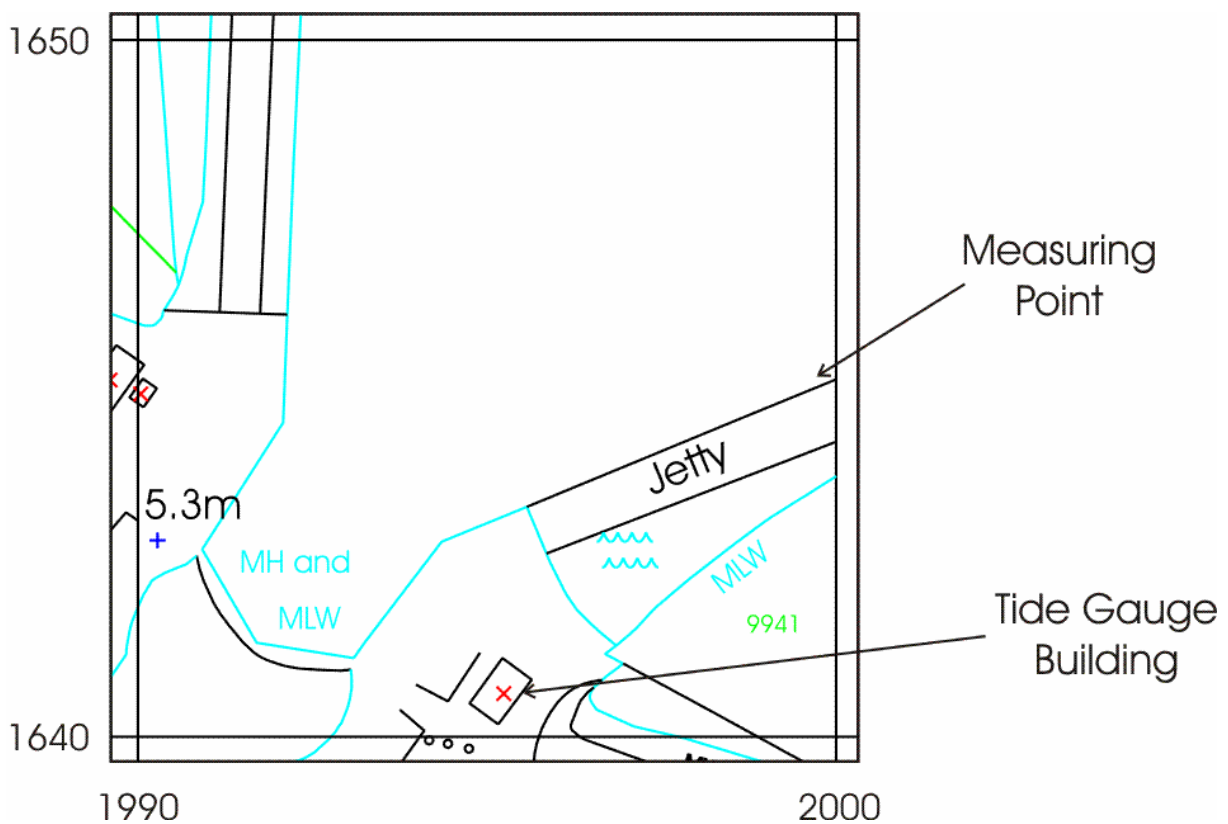
Longitude: 00° 11' 14.7" W

Grid Reference: TA 1996 1638

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is east of the lock gates at the entrance to Immingham Docks. The pressure points are fixed to a leg of the lead-in jetty on the east side of the entrance to Immingham Docks.



©Crown copyright. All rights reserved NERC 100017897 2009

## Port Erin (Isle of Man) Tide Gauge

Latitude: 54° 05' 07.4" N

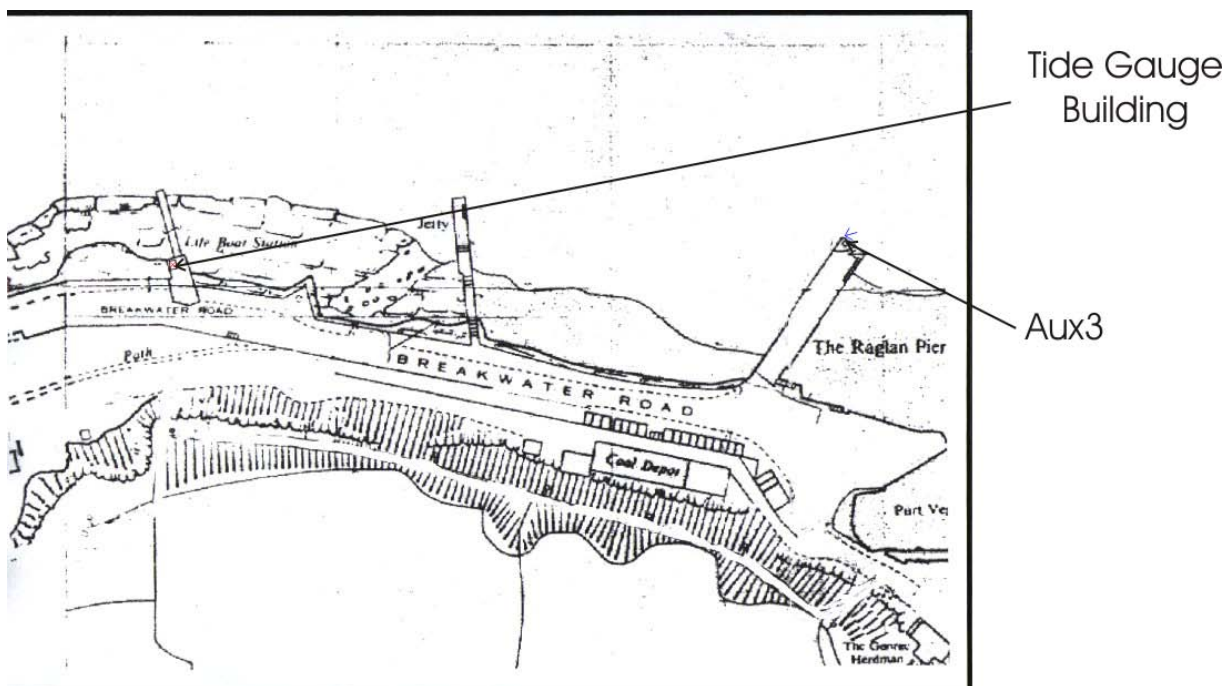
Longitude: 04° 46' 05.0" W

Grid Reference: SC 1904 6904

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge cabinet is located in Port Erin lifeboat station and the pressure points are mounted close to the end of the lifeboat slipway. The mid-tide pressure point is mounted on steelwork attached to a concrete leg of the boathouse.



©Isle of Man Harbours 2009



## Port Ellen (Isle of Islay) Tide Gauge

Latitude: 55° 37' 39.3" N

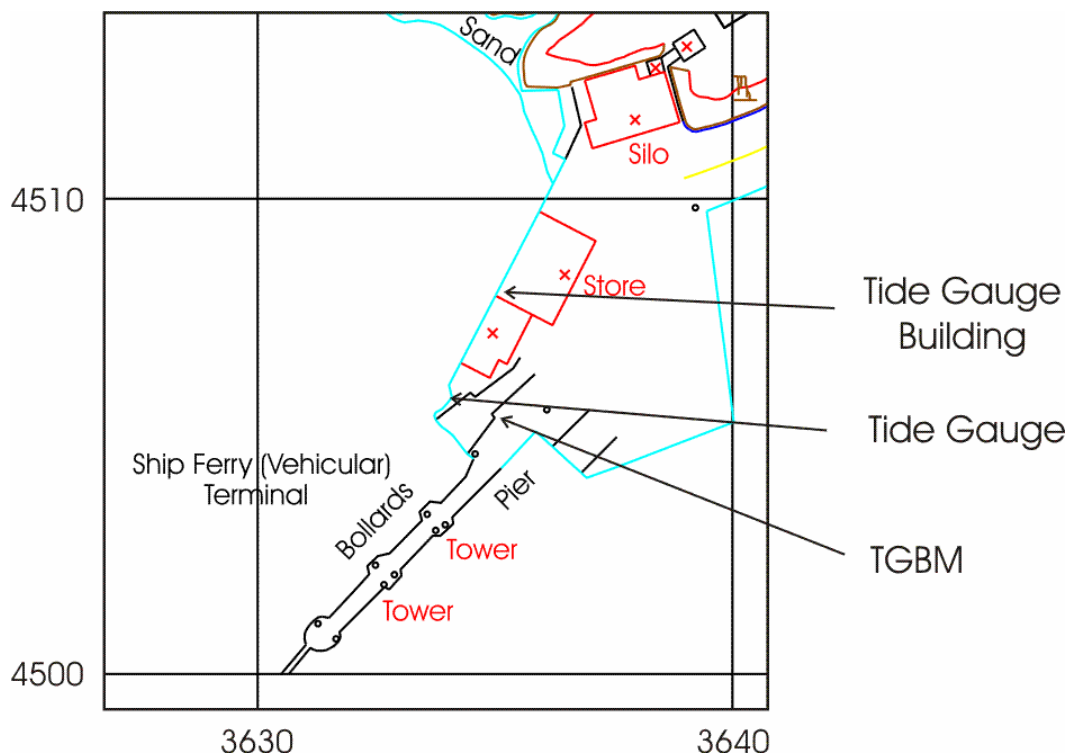
Longitude: 06° 11' 23.7" W

Grid Reference: NR 3636 4508

Instrument type: Data acquisition system with two full tide bubbler gauges installed.

Site of Gauge:

The tide gauge cabinet is located in the Caledonian MacBrayne storeroom next to Port Ellen ferry terminal. The pressure points are located south west of the ferry terminal offices.



©Crown copyright. All rights reserved NERC 100017897 2009



## St. Helier (Jersey) Tide Gauge

Latitude: 49° 11' 00" N

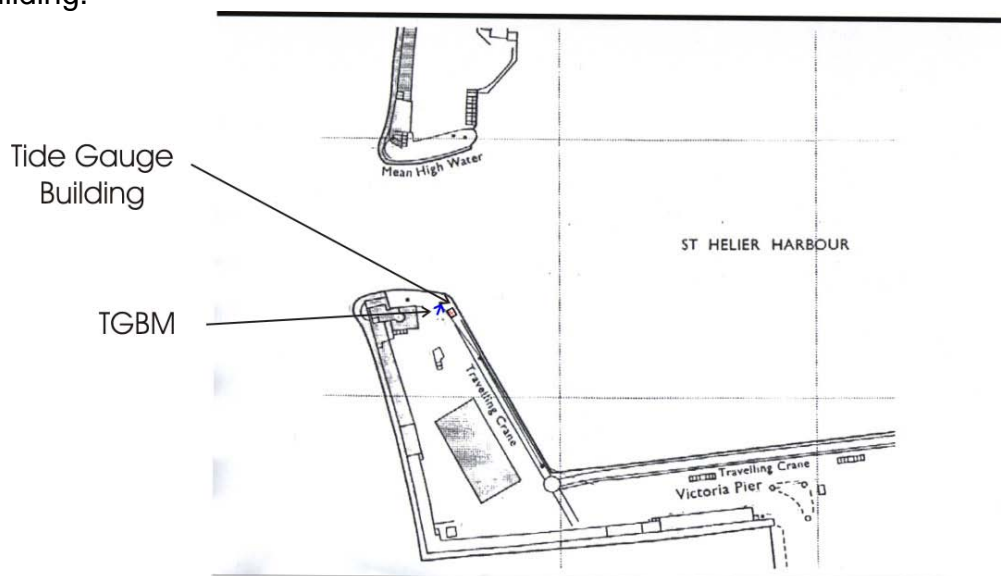
Longitude: 02° 07' 00" W

Grid Reference: 13/11 6466 4763

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is located on Victoria Pier, St. Helier, adjacent to the Port Control building. The pressure points are located on the inside wall of the pier, 2m from the tide gauge building.



©States of Jersey 2009



## Kinlochbervie Tide Gauge

Latitude: 58° 27' 23.8" N

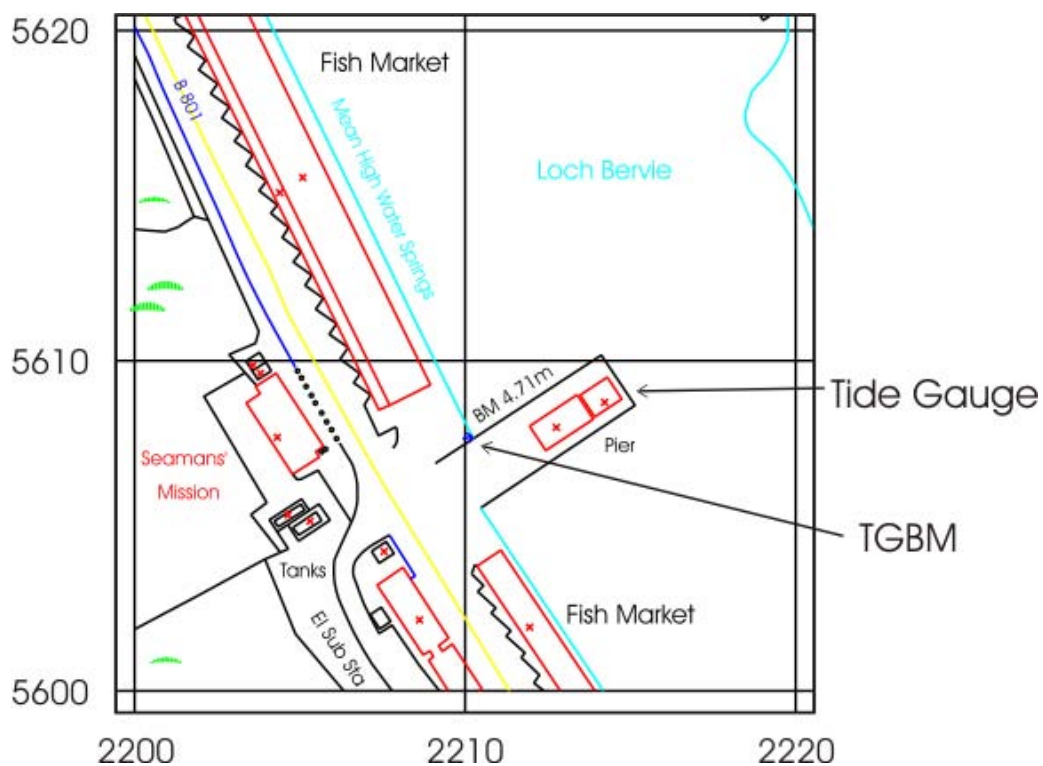
Longitude: 05° 03' 01.3" W

Grid Reference: NC 2213 5608

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge cabinet is located in the ice plant, on the pier. The pressure points are mounted on a leg of the jetty beneath the ice plant.



©Crown copyright. All rights reserved NERC 100017897 2009



## Leith Tide Gauge

Latitude: 55° 59' 23.4"N

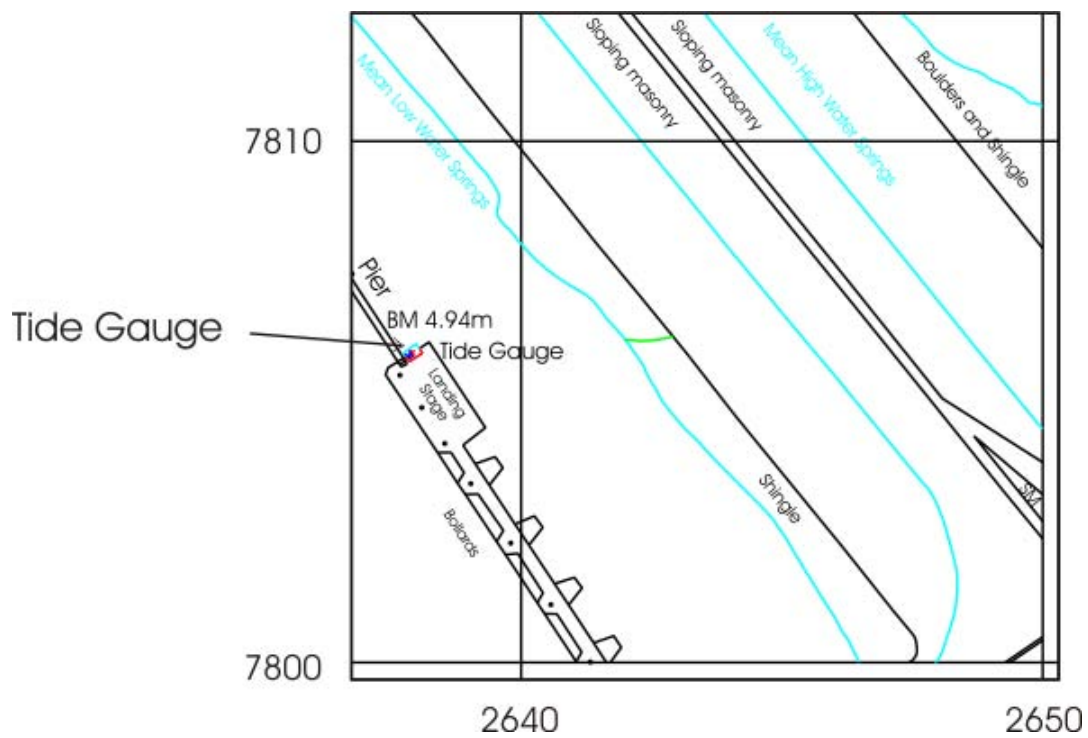
Longitude: 03° 10' 54.1"W

Grid Reference: NT 2638 7806

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building and pressure points are located on the lead-in jetty, east of the entrance to Leith docks.



©Crown copyright. All rights reserved NERC 100017897 2009



## Lerwick Tide Gauge

Latitude: 60° 09' 14.5" N

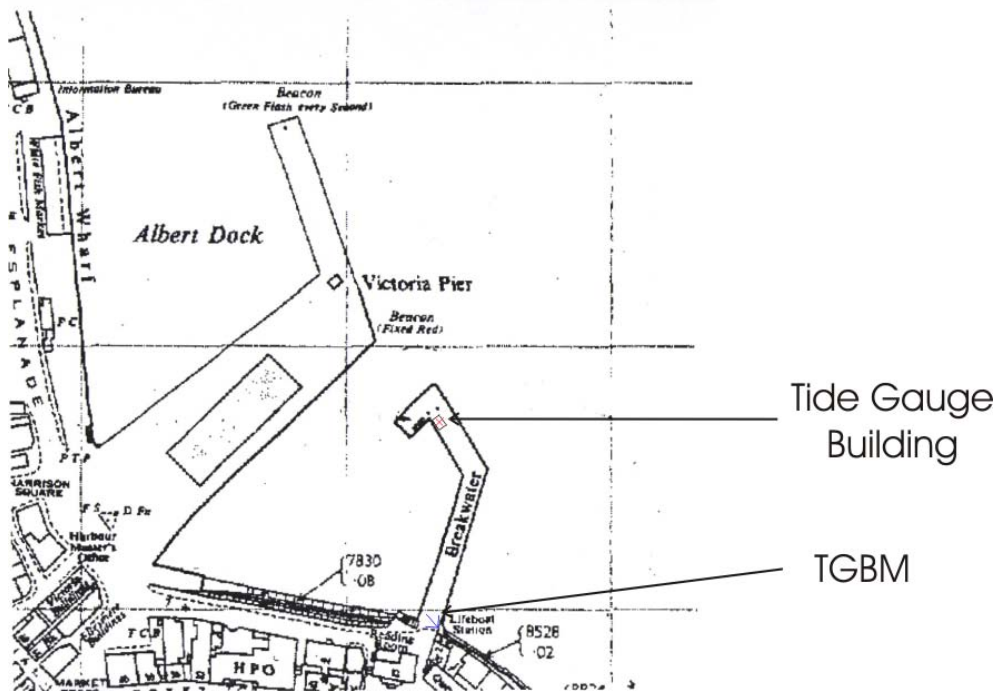
Longitude: 01° 08' 25.1" W

Grid Reference: HU 4783 4137

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed. Wind speed and wind direction are also recorded.

Site of Gauge:

The tide gauge building and measuring points are located on the inner wall at breakwater entrance to the small boat harbour, south of Victoria Pier, Lerwick.



©Crown copyright. All rights reserved NERC 100017897 2009



## Liverpool Tide Gauge

Latitude: 53° 26' 58.9" N

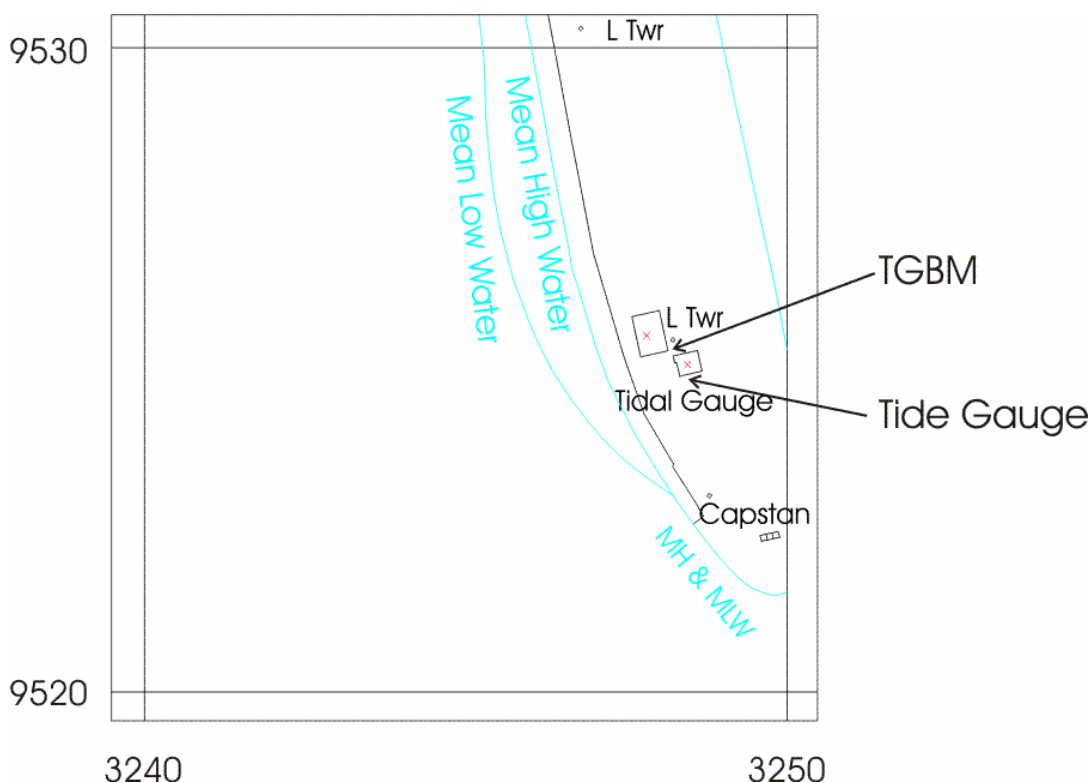
Longitude: 03° 01' 04.8" W

Grid Reference: SJ 3249 9525

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The Tide Gauge is located within the old Lock Keeper's office at the entrance to Gladstone Dock. The pressure points are located on the seaward side of Gladstone Dock. The wind speed and direction instruments are mounted at the top of the light tower located next to the tide gauge building.



©Crown copyright. All rights reserved NERC 100017897 2009





## Llandudno Tide Gauge

Latitude: 53° 19' 54.0" N

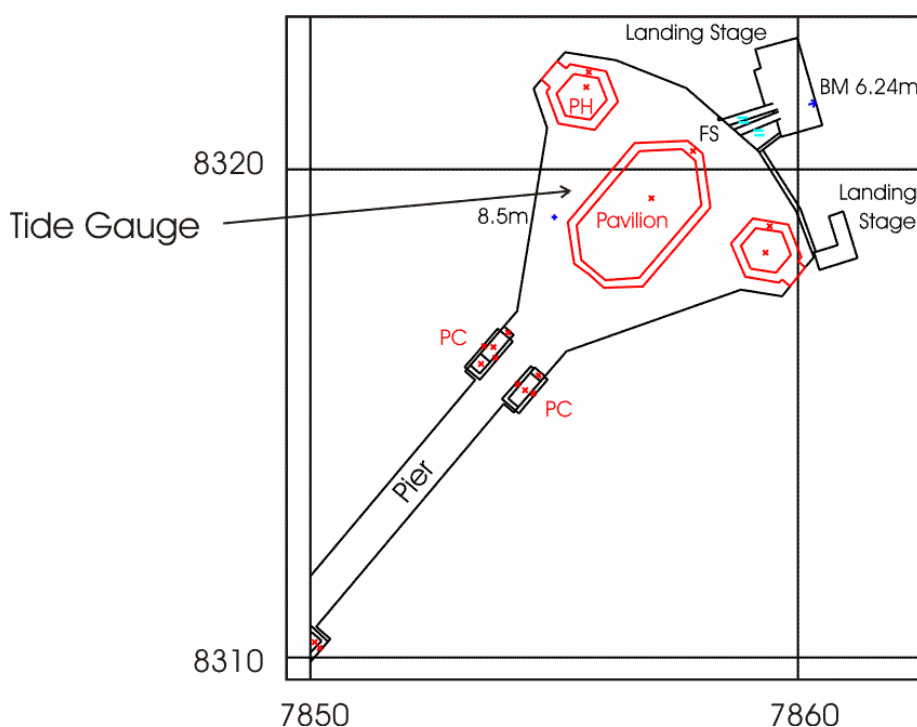
Longitude: 03° 49' 30.8" W

Grid Reference: SH 7855 8319

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is located on the sub-platform under the pavilion at the seaward end of Llandudno pier. The pressure points are located on a leg of the pier below the tide gauge building.



©Crown copyright. All rights reserved NERC 100017897 2009



## Lowestoft Tide Gauge

Latitude: 52° 28' 23.2" N

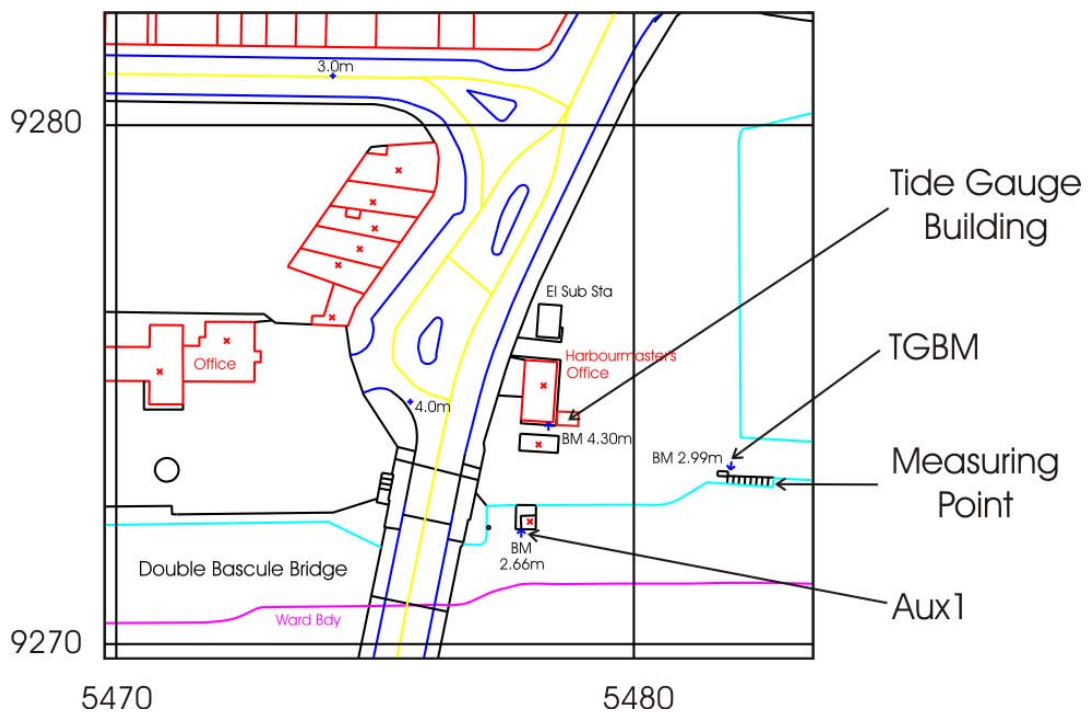
Longitude: 01° 45' 00.4" E

Grid Reference: TM 5478 9274

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is situated east of the Harbour Master's office with the pressure points located on the quay wall, east of the tide gauge building.



©Crown copyright. All rights reserved NERC 100017897 2009



## Milford Haven Tide Gauge

Latitude: 51° 42' 26.6" N

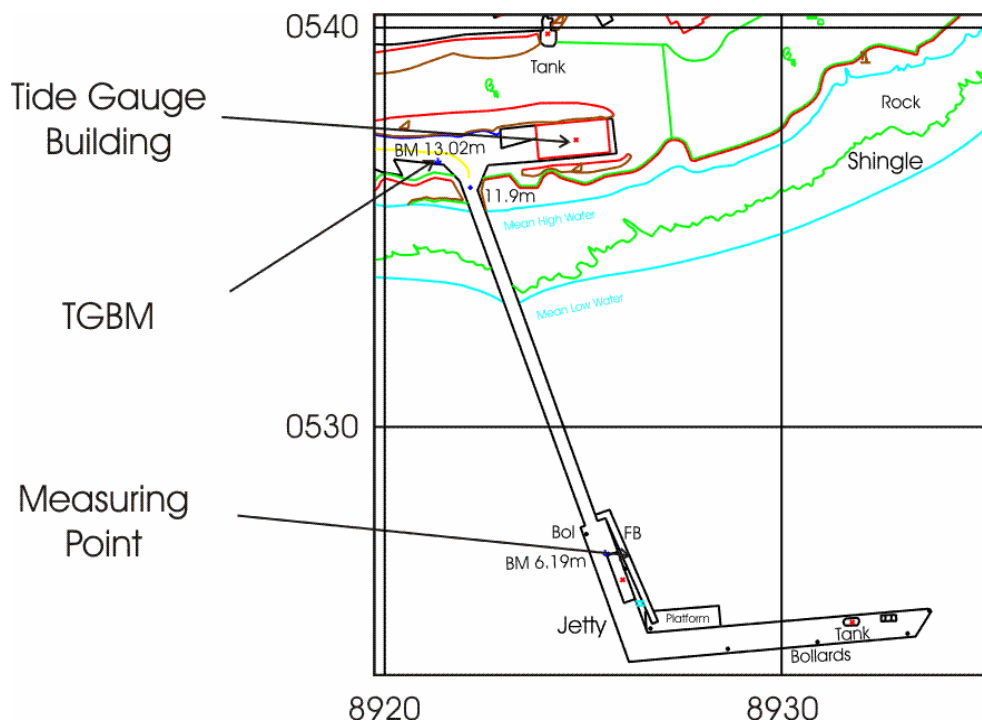
Longitude: 05° 03' 05.5" W

Grid Reference: SM 8925 0537

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge is located in the store room at the shore end of Milford Haven Port Authority jetty. The pressure points are mounted at the seaward end of the jetty.



©Crown copyright. All rights reserved NERC 100017897 2009



## Millport Tide Gauge

Latitude: 55° 44' 59.3" N

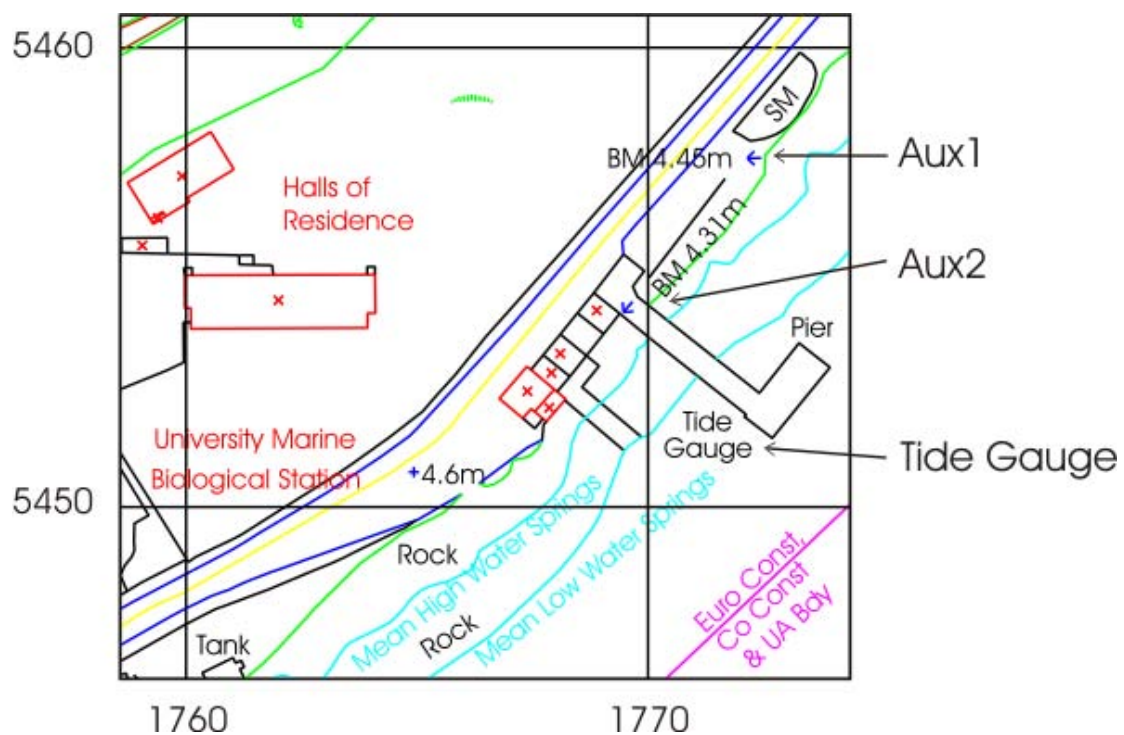
Longitude: 04° 54' 22.8" W

Grid Reference: NS 1769 5454

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge is housed in a storeroom at the shore end of the University Marine Biological Station pier. The pressure points are mounted at the seaward end of the pier.



©Crown copyright. All rights reserved NERC 100017897 2009



## Mumbles Tide Gauge

Latitude: 51° 34' 12.0" N

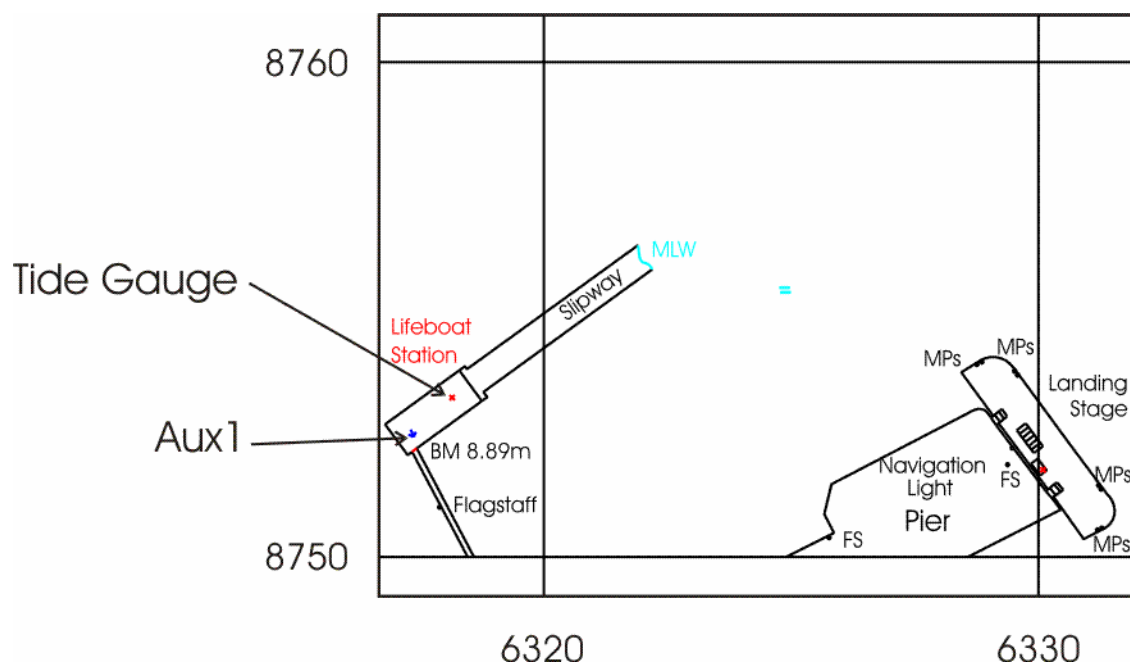
Longitude: 03° 58' 31.6" W

Grid Reference: SS 6319 8753

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge cabinet is located in the Mumbles lifeboat station and the pressure points are mounted close to the end of the lifeboat slipway.



©Crown copyright. All rights reserved NERC 100017897 2009



## Newlyn Tide Gauge

Latitude: 50° 06' 10.8" N

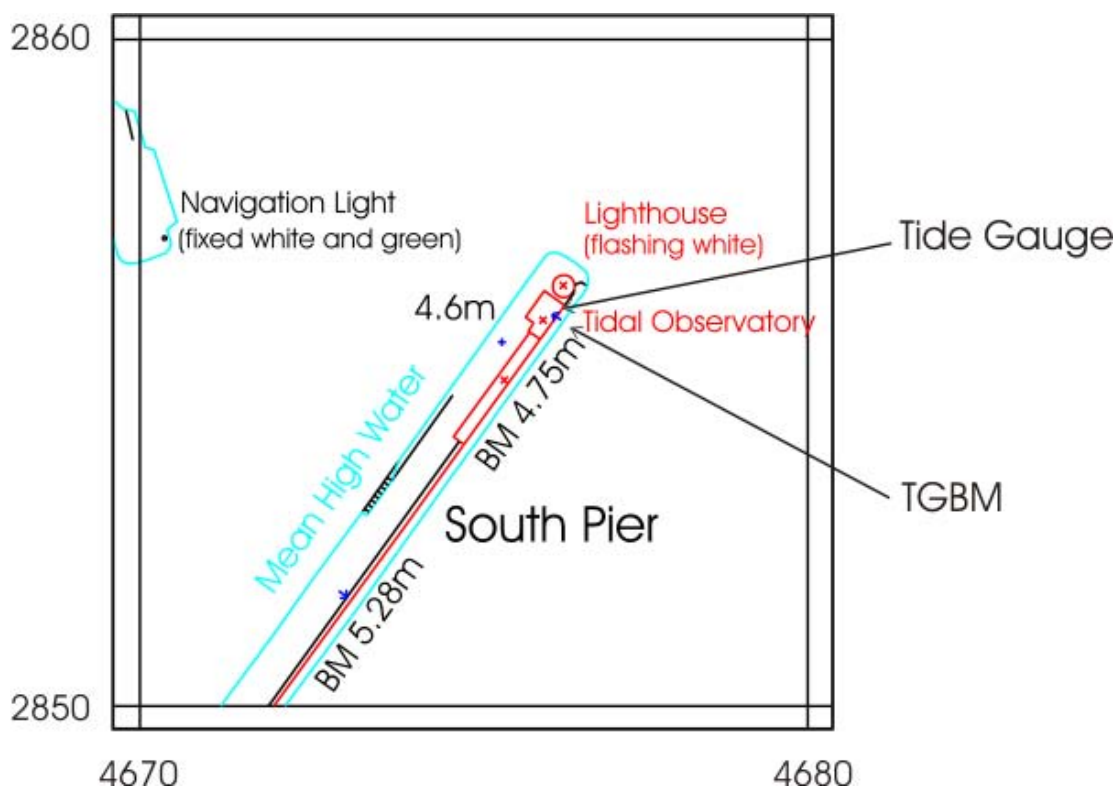
Longitude: 05° 32' 34.2" W

Grid Reference: SW 4676 2856

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

Site of Gauge:

The Tidal Observatory is located at the end of South Pier, next to the lighthouse. The pressure points are located on the seaward side of the pier, behind the lighthouse.



©Crown copyright. All rights reserved NERC 100017897 2009



## Newhaven Tide Gauge

Latitude: 50° 46' 54.4" N

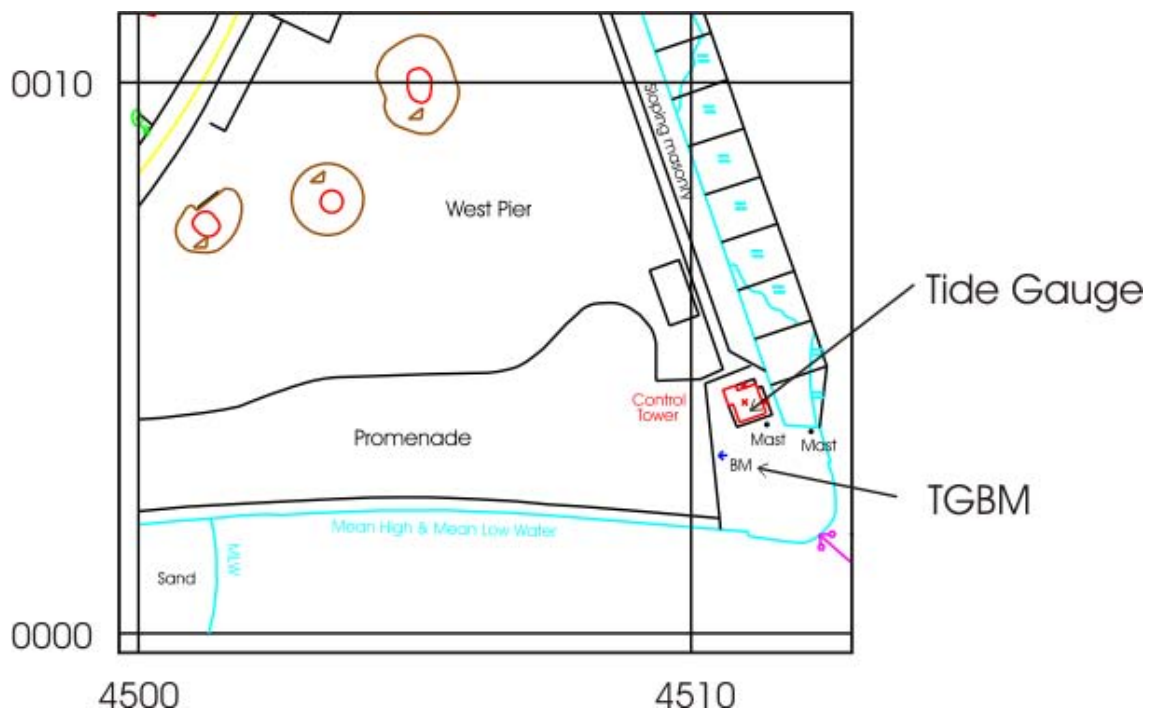
Longitude: 00° 03' 25.3" E

Grid Reference: TQ 4511 0004

Instrument type: Data acquisition system with two full tide bubbler gauges installed.

Site of Gauge:

The tide gauge is located within the Port Control building on West Pier, and the pressure points are located on the pier wall, south east of the Port Control building. The anemometer and wind vane are located on the signals mast.



©Crown copyright. All rights reserved NERC 100017897 2009



## Newport Tide Gauge

Latitude: 51° 33' 00.0" N

Longitude: 02° 59' 14.8" W

Grid Reference: ST 3163 8392

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is located on the west side of the entrance to Newport Docks. The pressure points are attached to the dock wall on the west side of the dock entrance, close to the lock gates.



©Crown copyright. All rights reserved NERC 100017897 2009





## North Shields Tide Gauge

Latitude: 55° 00' 26.8" N

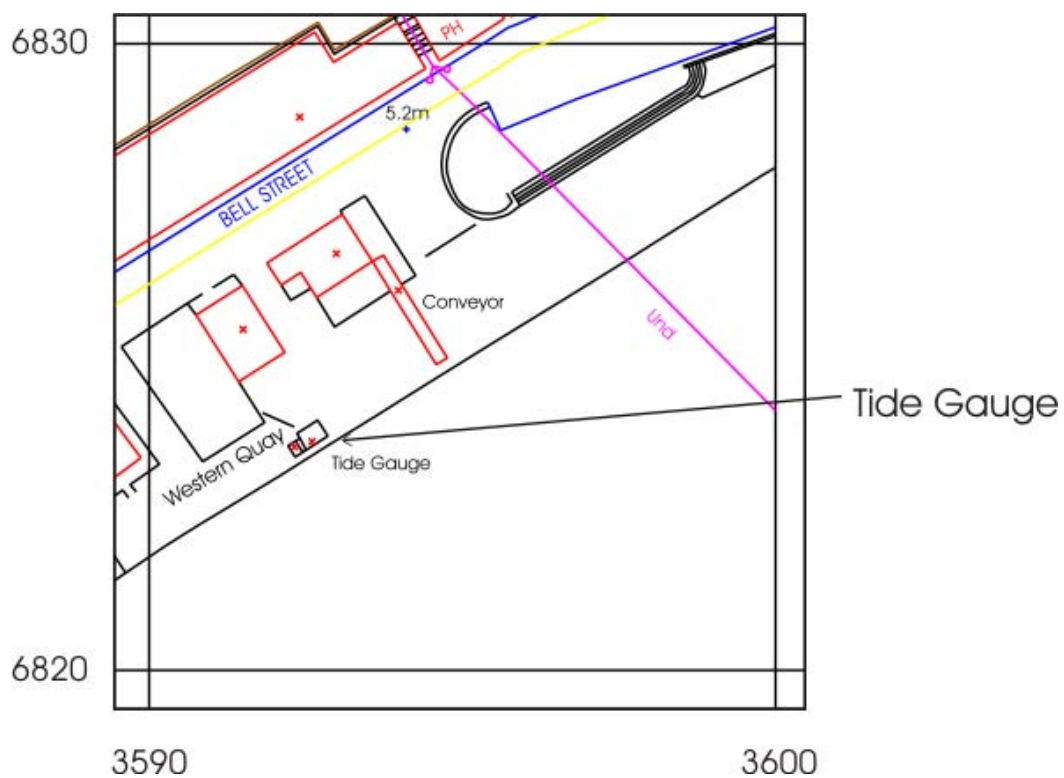
Longitude: 01° 26' 23.2" W

Grid Reference: NZ 3592 6823

Instrument type: Data acquisition system with potentiometers attached to the Munro float gauge and the Wellhead float gauge installed.

Site of Gauge:

The tide gauge building is located on the north side of the River Tyne, close to the Port of Tyne Authority offices.



©Crown copyright. All rights reserved NERC 100017897 2009



## Portpatrick Tide Gauge

Latitude: 54° 50' 33.2" N

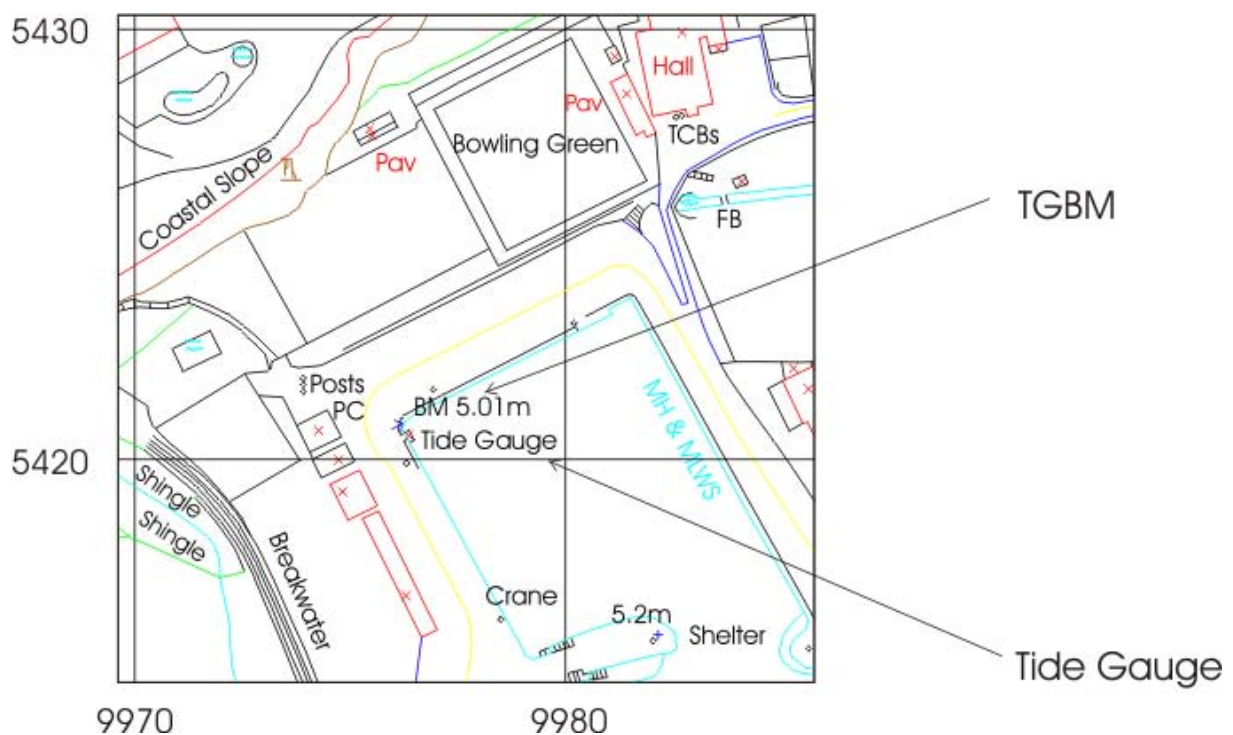
Longitude: 05° 07' 12.1" W

Grid Reference: NW 9976 5421

Instrument type: Data acquisition system with a full tide bubbler gauge and a potentiometer attached to an installed Munro float gauge.

Site of Gauge:

The tide gauge building is mounted over the stilling well in the corner of Portpatrick harbour. The pressure point is located directly beneath the building.



©Crown copyright. All rights reserved NERC 100017897 2009



## Portrush Tide Gauge

Latitude: 55° 12' 24.4" N

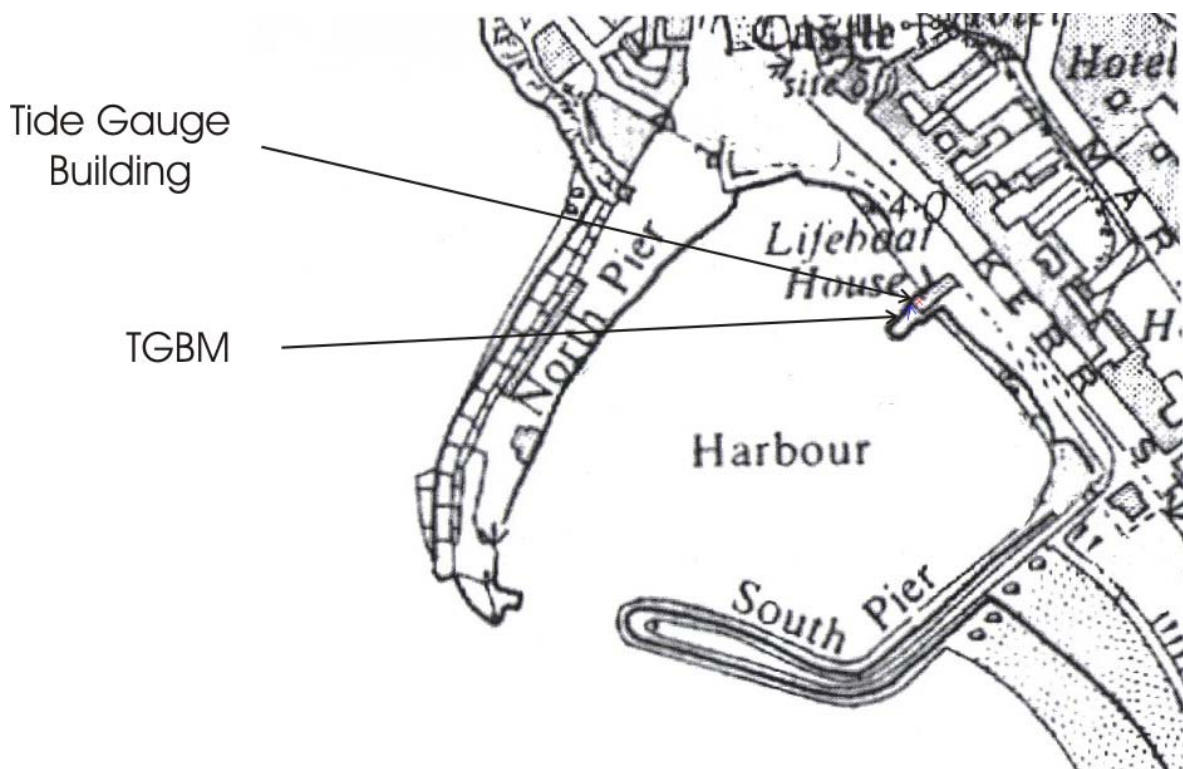
Longitude: 06° 39' 24.6" W

Grid Reference: NW 0416 9952

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge cabinet is located in the RNLI boathouse, with the pressure points fixed to a leg of the slipway.



## Portbury Tide Gauge

Latitude: 51° 30' 00.0" N

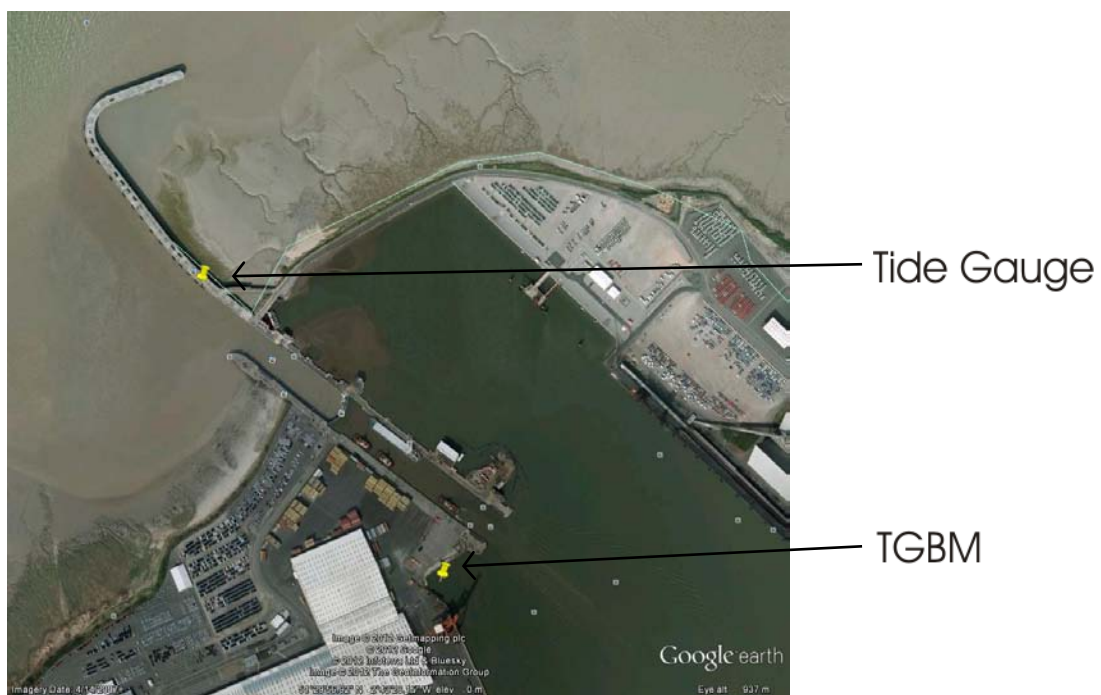
Longitude: 02° 43' 42.5" W

Grid Reference: ST 4933 7815

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge cabinet is located on the western, seaward side of the jetty. The pressure points are mounted on the wall below the tide gauge cabinet.



© 2012 Infoterra Ltd & Bluesky  
© 2012 Google  
Image © 2012 Getmapping plc  
Image © 2012 The Geoinformation Group



## Portsmouth Tide Gauge

Latitude: 50° 48' 08.1" N

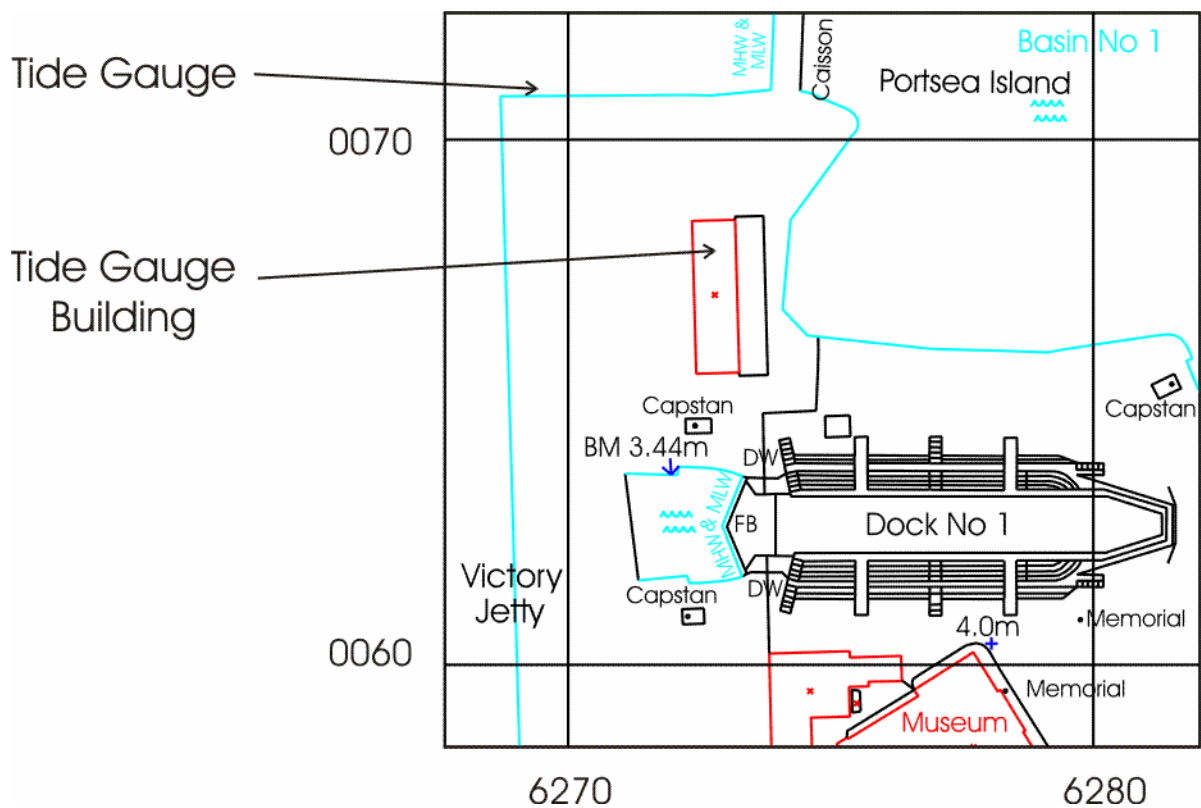
Longitude: 01° 06' 40.5" W

Grid Reference: SU 6273 0068

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is located on Victory Jetty in the Royal Naval base. The pressure points are mounted on a leg at the north west corner of the jetty.



©Crown copyright. All rights reserved NERC 100017897 2009

## Sheerness Tide Gauge

Latitude: 51° 26' 44.3" N

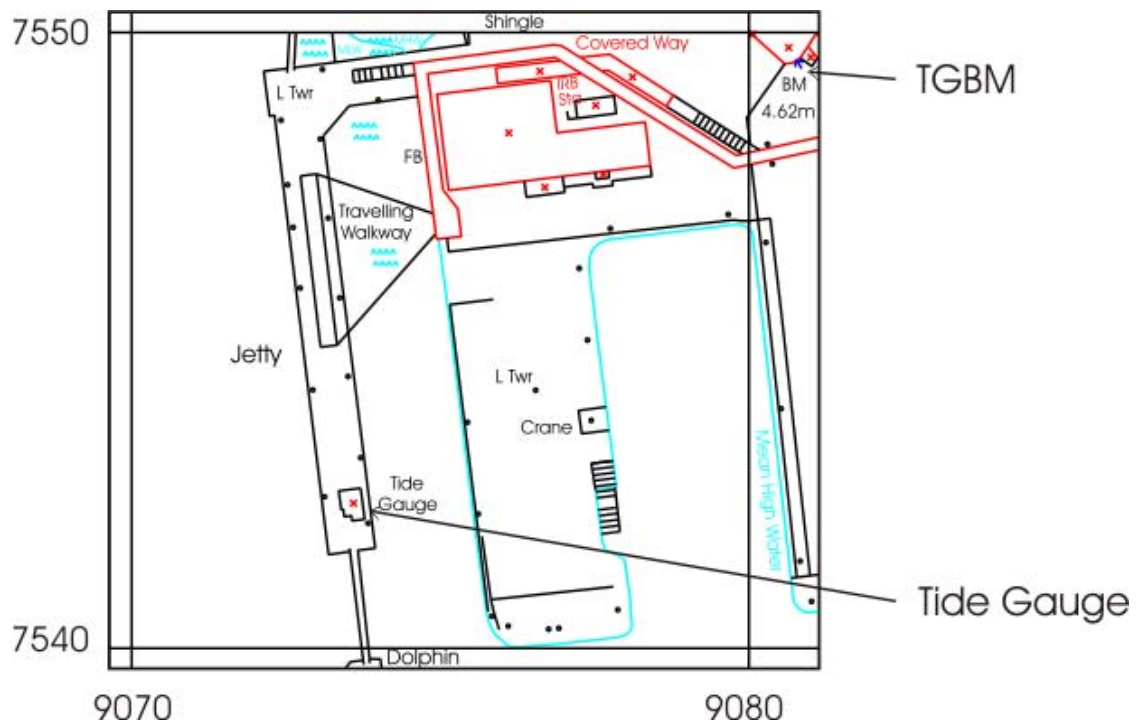
Longitude: 00° 44' 36.4" E

Grid Reference: TQ 9074 7542

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is located on the jetty at Garrison Point, in the Port of Sheerness.



©Crown copyright. All rights reserved NERC 100017897 2009



## St. Mary's (Isles of Scilly) Tide Gauge

Latitude: 49° 55' 04.3" N

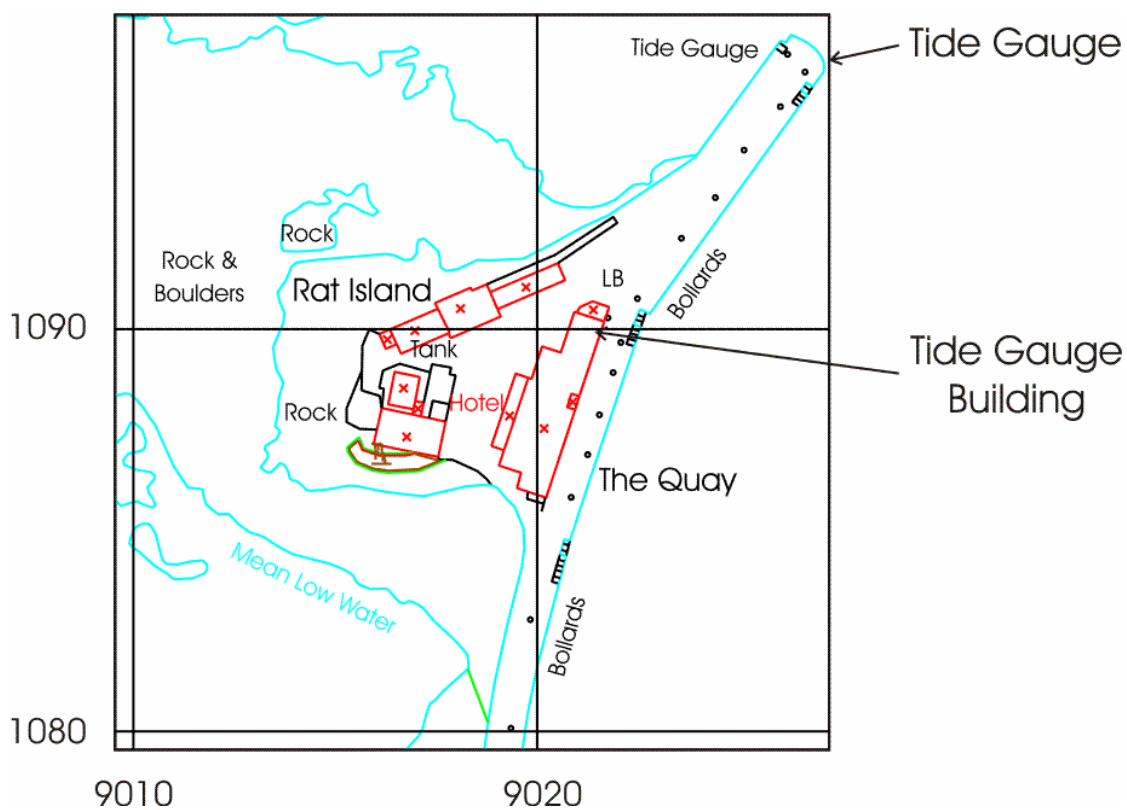
Longitude: 06° 19' 02.0" W

Grid Reference: SV 9021 1090

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge cabinet is located in the Harbour Office storeroom on The Quay, Hugh Town. The pressure points are located on the nose of the quay.



©Crown copyright. All rights reserved NERC 100017897 2009



## Stornoway Tide Gauge

Latitude: 58° 12' 28.1" N

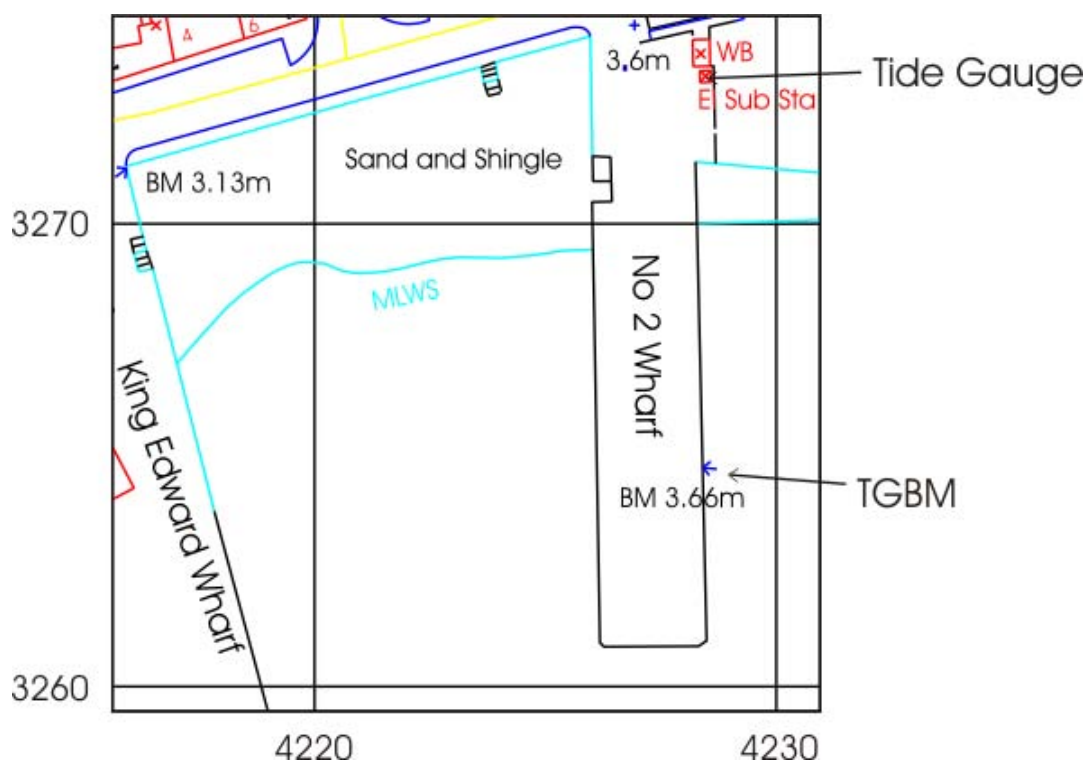
Longitude: 06° 23' 20.3" W

Grid Reference: NB 4228 3274

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is located by the weighbridge at the entrance to Stornoway Port Authority, No. 2 wharf. The pressure points are attached to a leg on the east side of the wharf.



©Crown copyright. All rights reserved NERC 100017897 2009





## Tobermory Tide Gauge

Latitude: 56° 37' 23.2" N

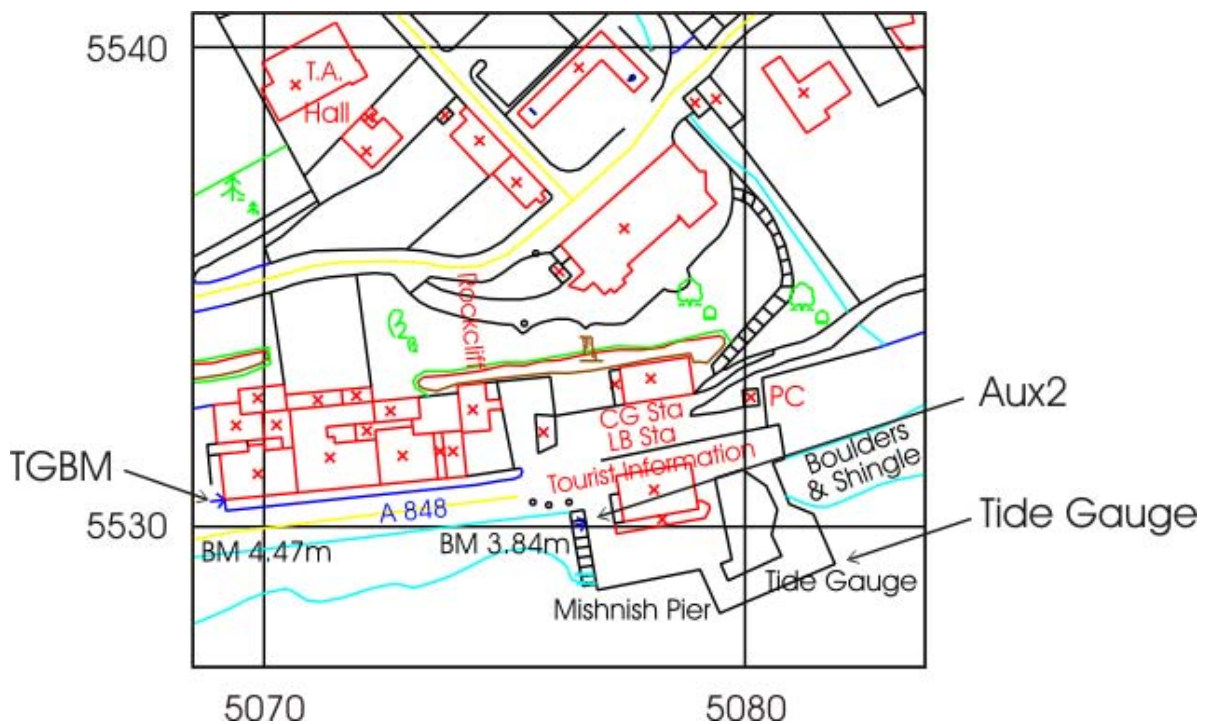
Longitude: 06° 03' 51.2" W

Grid Reference: NM 5079 5531

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge cabinet is located in the Caledonian MacBrayne ferry terminal on Mishnish Pier, Tobermory, and the pressure points are located on one of the pier legs.



©Crown copyright. All rights reserved NERC 100017897 2009



## Ullapool Tide Gauge

Latitude: 57° 53' 42.9" N

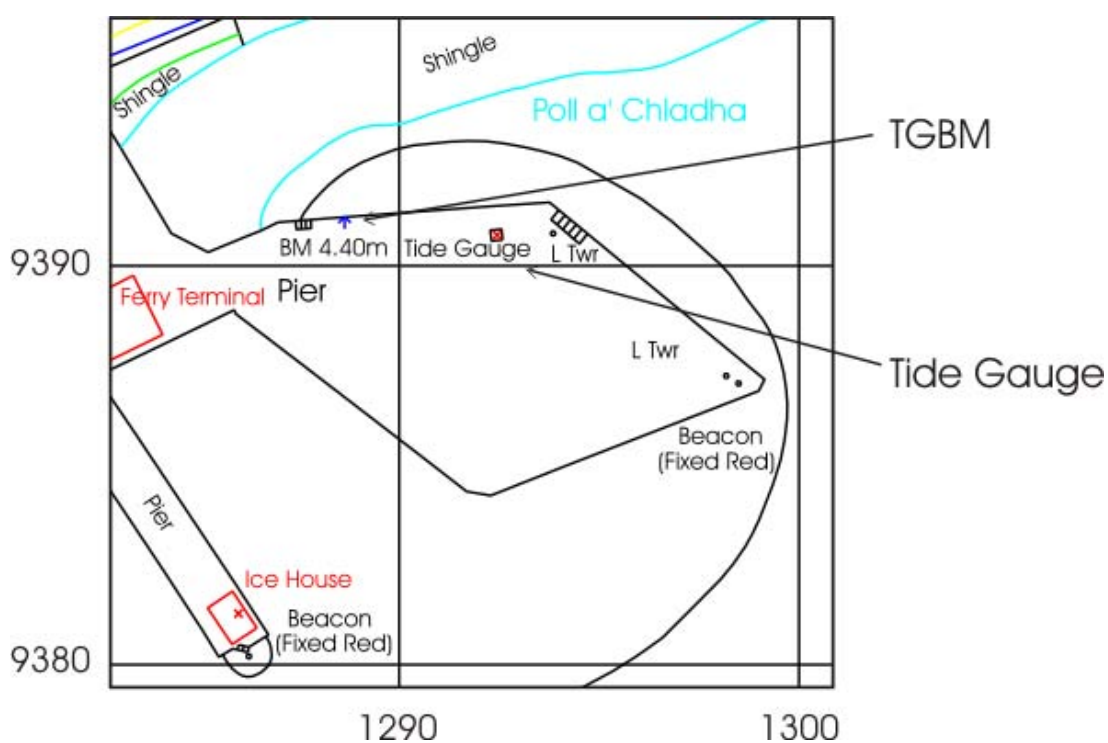
Longitude: 05° 09' 28.4" W

Grid Reference: NH 1293 9391

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

Site of Gauge:

The tide gauge building is located on the pier, Ullapool harbour. The pressure points are mounted below the tide gauge building.



©Crown copyright. All rights reserved NERC 100017897 2009



## Weymouth Tide Gauge

Latitude: 50° 36' 30.6" N

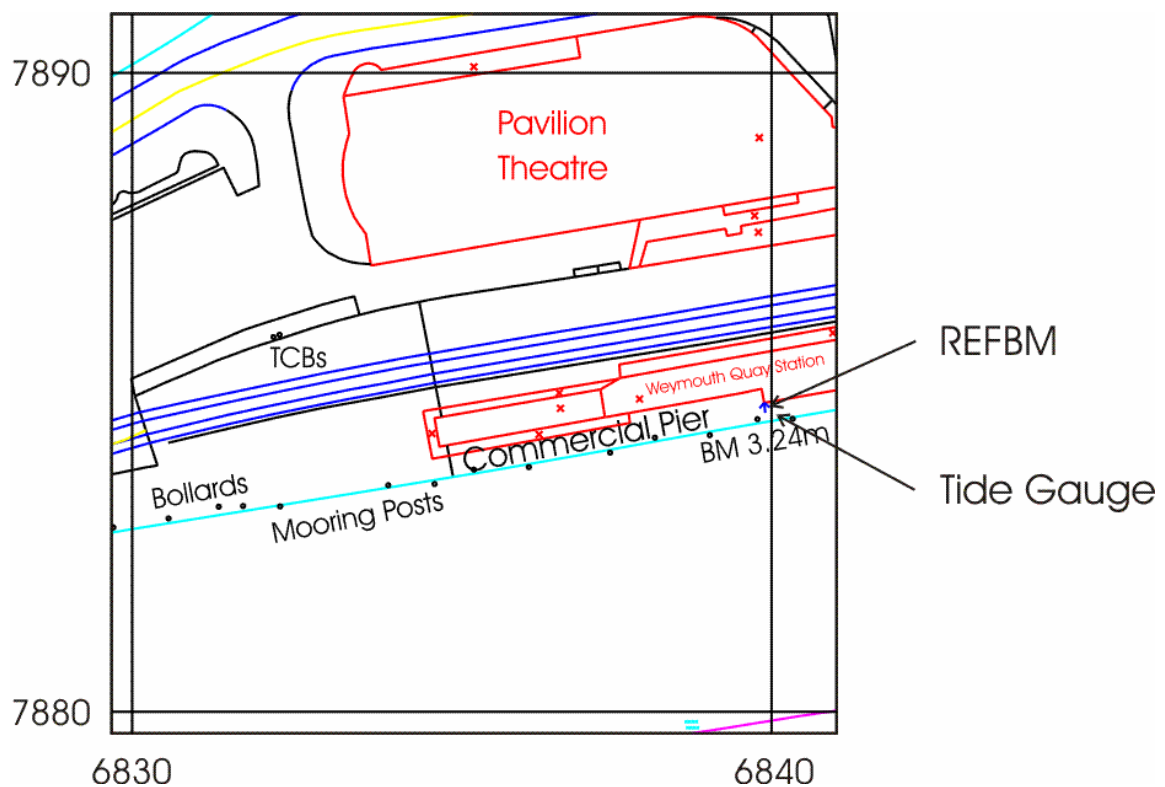
Longitude: 02° 26' 52.6" W

Grid Reference: SY 6840 7885

Instrument type: Data acquisition system with two full tide bubbler gauges installed.

Site of Gauge:

The tide gauge building is located on Commercial Pier, adjacent to the ferry terminal. The pressure points are located on the pier wall, directly in front of the tide gauge building.



©Crown copyright. All rights reserved NERC 100017897 2009



## Whitby Tide Gauge

Latitude: 54° 29' 24.0" N

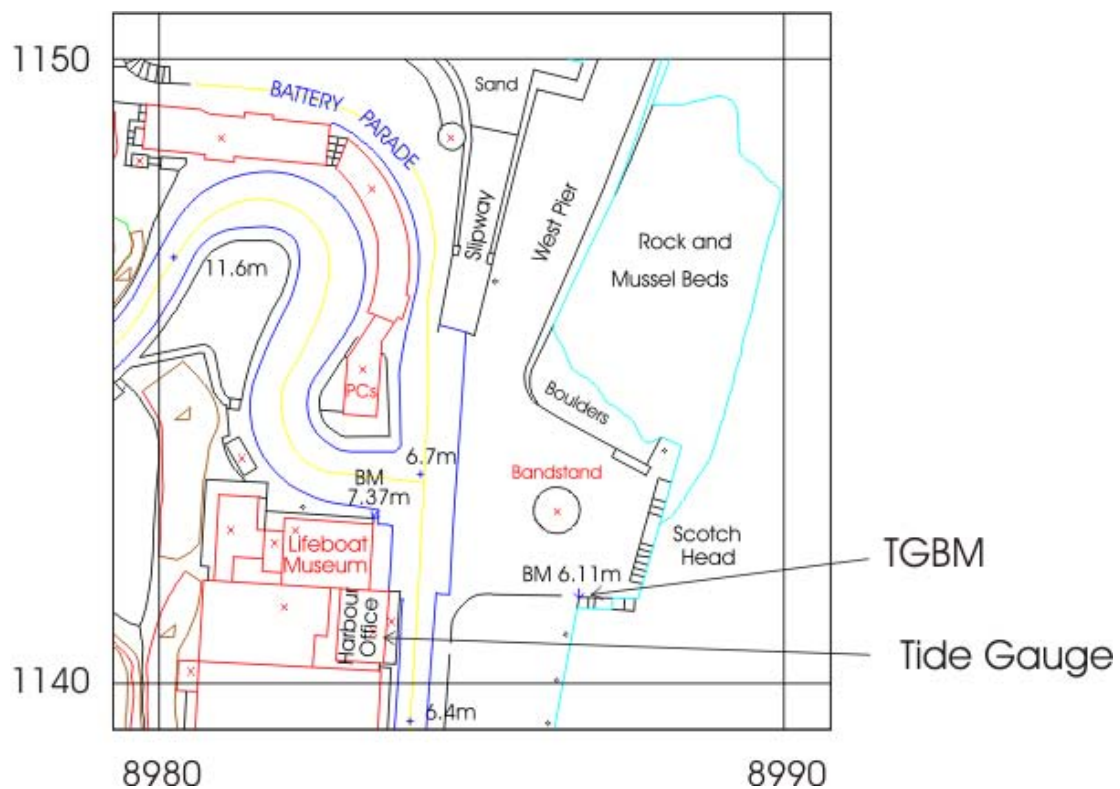
Longitude: 00° 36' 52.9" W

Grid Reference: NZ 8984 1140

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge is located in the Harbour Master's office, Pier Road. The pressure points are positioned underneath the quay, adjacent to the Harbour Office.



©Crown copyright. All rights reserved NERC 100017897 2009



## Wick Tide Gauge

Latitude: 58° 26' 27.5" N

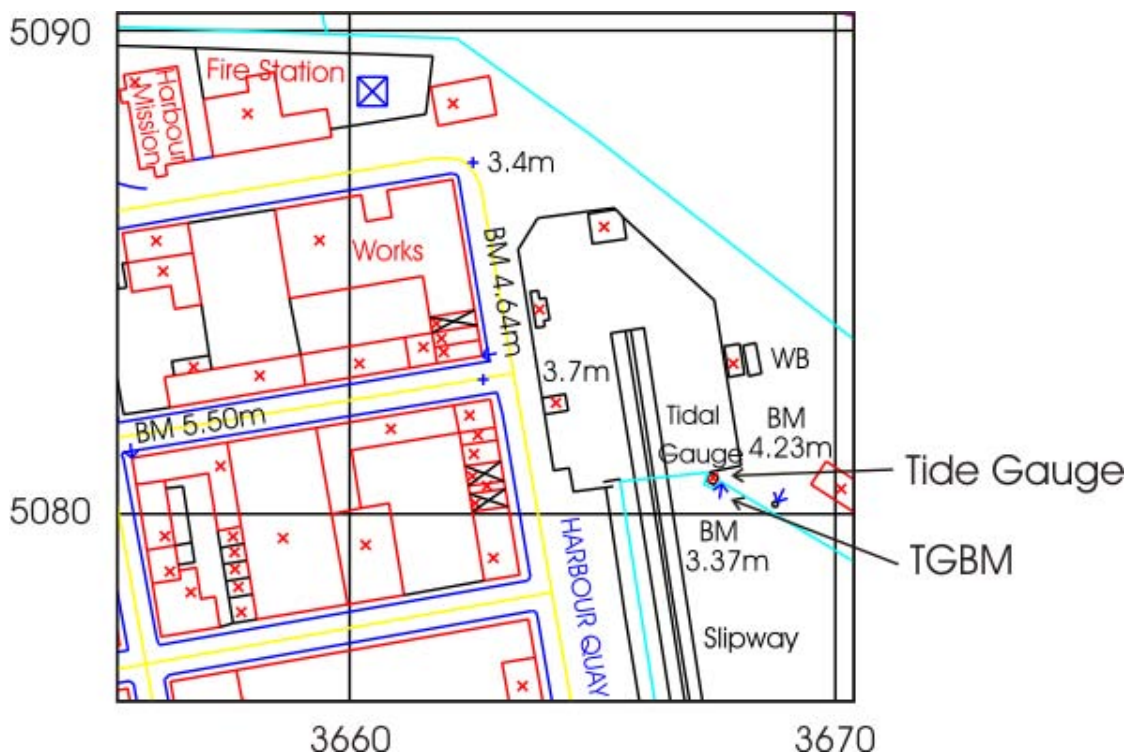
Longitude: 03° 05' 10.7" W

Grid Reference: ND 3668 5081

Instrument type: Data acquisition system with two full tide and a mid-tide bubbler gauge installed.

Site of Gauge:

The tide gauge building is sited in the north west corner of Wick harbour next to the ship repair slipway. The pressure points are attached to an unused stilling well beneath the building.



©Crown copyright. All rights reserved NERC 100017897 2009



## Workington Tide Gauge

Latitude: 54° 39' 02.6" N

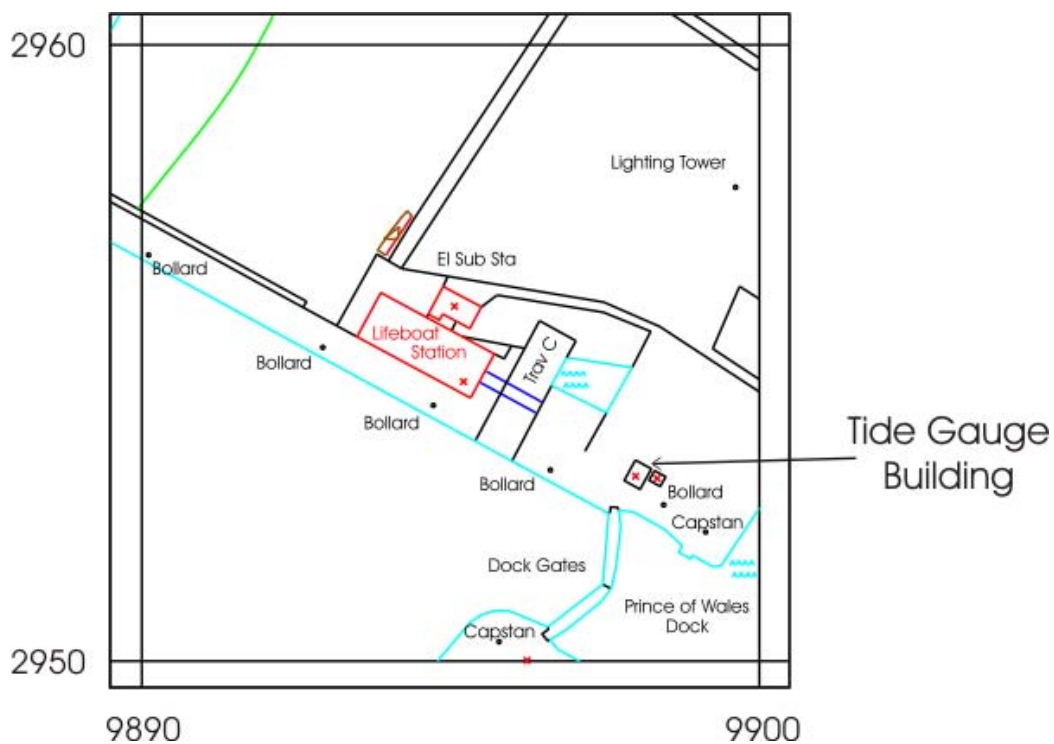
Longitude: 03° 34' 01.8" W

Grid Reference: NX 9898 2953

Instrument type: Data acquisition system with two full tide bubbler gauges installed.

Site of Gauge:

The tide gauge is located in a concrete building on the north side of the dock entrance. The pressure points are located behind fender piles on the north seaward side of the dock gates. The wind speed and direction instruments are mounted at the top of the mast located next to the tide gauge building.



©Crown copyright. All rights reserved NERC 100017897 2009

