



Scotland's centre of expertise for waters

# Dynamic Coast - National Coastal Change Assessment: Data Audit





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# National Coastal Change Assessment Steering Committee



# Data Audit

## *Dynamic Coast – Scotland's National Coastal Change Assessment*

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### Executive Summary

- The vast majority of the datasets required for the NCCA are available under the standard terms for public bodies or have been licensed specifically. This should ensure there are no restrictions on the majority of project partners to view the data and use the assessment.
- Where there are restrictions, these will be managed and made explicit to project partners to ensure they are aware of any implications.
- As additional datasets become available this document will be revised.

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## 1.0 Introduction & Restrictions

This report summarises the datasets used within the National Coastal Change Assessment and outlines their copyright status. The NCCA aims to improve the evidence base for past and anticipated coastal change in Scotland. This desk-based assessment will use readily available national datasets to compare the past, recent and current position of Scotland's coastline. As a national-level assessment, the project relies on datasets which are nationally consistent datasets, wherever possible.

## 2.0 Data sets

### 2.1 Summary Table

The following table summarises the datasets used within the CESM and supplementary datasets.

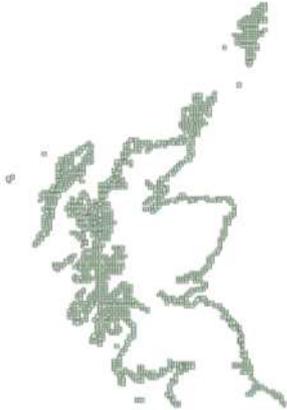
*Table 2.1: Datasets used with the National Coastal Change Assessment*

Simple Name	Name	Supplier	Epoch	Copyright	Restrictions	Costs
Historical mapping	2 <sup>nd</sup> Edition County Series	NLS	1890-1910	Out of ©	None	None
1970s mapping	1970s geotifs	NLS	1950-1985	OSMA	None	None
Recent mapping	OSMM	OS	1985-2014	OSMA	Yes	None
Current mapping	Lidar & digital photogrammetry	SG, SNH, HS etc	2006 - 2013	various	Some	None
DTM	OS-50 DTM	OS	N.A.	Open source	None	None
Rockhead	Superficial Thickness Model - Rockhead Output	BGS	N.A.	Yes	Yes	£692
Open coast	Revised OSMM MHWS	OS	N.A.	OSMA	None	None
Exposure	tbc	Bentley et al	N.A.	Open source	None	None
Defences	N.A.	GU/SNH	2009-13	Derived from GetMapping	None	None
Coastal Accretion	N.A.	GU/SNH	2009-13	Derived from GetMapping	None	None
Aerial Photography	GetMapping	GetMapping	2009-13	OSMA	Some	None
Flood Map	SEPA Flood Hazard Map	SEPA	N.A.	©SEPA	Some	None
Erosion	EUrosion (2010 update)	SNH	2010	EU / SNH	Open Source	None
Erosion	SNH casework	SNH	2005-2015	SNH	None	None
Archaeology at risk	CZAS & SCHARP	Scape / St Andrews	t.b.c.	© Scape	t.b.c.	None
Asset data	Various	SEPA, SNH, HS	t.b.c.	t.b.c.	t.b.c.	None

## 2.2 Historical data (ca. 1900)

The choice of which historical (i.e. nineteenth century) map to use was considered at a meeting with Scottish Government, SNH, SEPA, National Library of Scotland (NLS), the Ordnance Survey and the University of Glasgow on the 15<sup>th</sup> December 2014. Whilst the First Edition County Series was held electronically by the NLS the maps were not georectified. This meant that each map tile would need to be positioned to enable accurate comparisons between datasets within the GIS. The NLS has the Second Edition County Series georectified and has made these available to the project.

Testing is ongoing regarding the current accuracy of the georectification of the 2<sup>nd</sup> Edition maps and any improvement that may be required. The methodology for this is being discussed between expert advisors.

Data Summary	Historical Data ca 1900	
Dataset name	OS 2nd Edition, 6 inch, county series	
Owner	The Ordnance Survey	
Supplier	The National Library of Scotland	
Copyright status	Out of copyright	
Contact	Chris Fleet (NLS)	
Extent	National coverage	
Scale	6 inch = 1:10,560	
Restrictions	None, viewable by anyone	
Epoch	1890 to 1959	
Costs	None	
Acknowledgement	The National Library of Scotland	
<p>Map showing coverage</p> 	<p>Map showing insert</p> 	

### 2.3 1970s OS maps

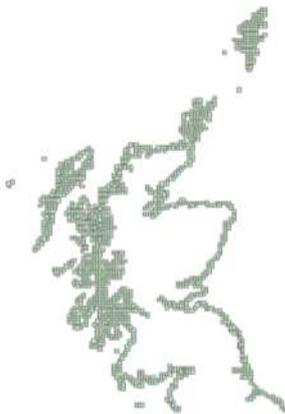
It was considered desirable to include intervening mapping between the 1900s and our most up to date sources. Discussions with the OS confirmed that the so called 1970s mapping was particularly useful to the project as all of the line-work was based on newly collected aerial surveys, rather than relying on updated earlier surveys. Metadata detailing the survey dates for each map tile was also available along with electronic scans of the maps from NLS.

Discussions between the SG and the OS have resulted in these data being made available under the One Scotland Mapping Agreement (OSMA).

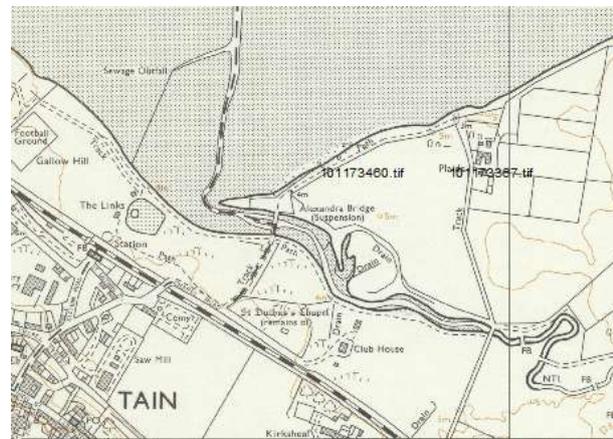
Data Summary	1970s mapping
Dataset name	OS 1970s geo-tiffs
Owner	The Ordnance Survey
Supplier	The National Library of Scotland
Copyright status	One Scotland Mapping Agreement
Contact	Dominic Cuthbert (OS)
Extent	National coverage
Scale	1:10,000
Restrictions	Viewable by anyone within the Scottish Public Sector
Epoch	1956 to 1995
Costs	None
Acknowledgement	OSMA

<https://www.ordnancesurvey.co.uk/business-and-government/public-sector/mapping-agreements/one-scotland-mapping-agreement.html>

Map showing coverage



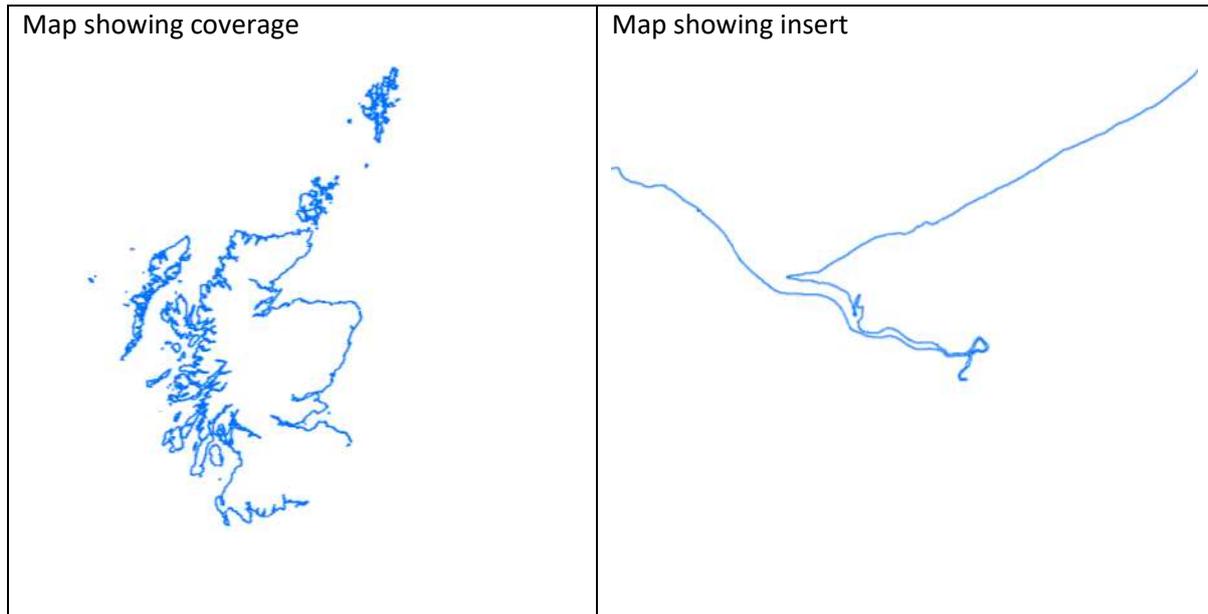
Map showing insert



## 2.4 Recent Mapping

The OS MasterMap dataset has been used as the recent dataset. Discussions with the OS have highlighted that the survey date of individual lines is not well known. Whilst the Version Date field (VERDATE) may be expected to reflect the survey date, this cannot be relied on and may reflect other non-position changes. Uncertainty in the survey date greatly reduces the value of these datasets for change assessments. As a result the NCCA was unable to take the OS MasterMap MHWS line at face value and an exhaustive audit was undertaken. This considered the whole coastline against recent aerial photography (Getmapping photography via OSMA within the last 5 years). This was used to define the areas of soft coast, which was then compared with the OS MasterMap MHWS line, buffered on its 'Accuracy figure'. Areas which were inconsistent with MHWS were identified and discussed with the OS. Areas covered by the SG LiDAR survey were going to be updated, given the higher accuracy of this data, but beyond these areas 17% of the soft MHWS was inconsistent with the aerial photography, and required an update. The OS's 2016 flying season included all areas as a priority, and a substantial proportion has been flown and updated surface models have been received and a proportion has been incorporated where time permits. A proportion of the received data is being held and will be incorporated within the next stage of the work.

Data Summary	Recent mapping
Dataset name	OS MasterMap
Owner	The Ordnance Survey
Supplier	The Ordnance Survey
Copyright status	One Scotland Mapping Agreement
Contact	Dominic Cuthbert (OS)
Extent	National coverage
Scale	1:10,000
Epoch	'2001 to 2016', however some line work taken from 1970s survey
Restrictions	Viewable by anyone within the Scottish Public Sector
Costs	None
Acknowledgement	OSMA
<a href="https://www.ordnancesurvey.co.uk/business-and-government/public-sector/mapping-agreements/one-scotland-mapping-agreement.html">https://www.ordnancesurvey.co.uk/business-and-government/public-sector/mapping-agreements/one-scotland-mapping-agreement.html</a>	



## 2.5 Current datasets

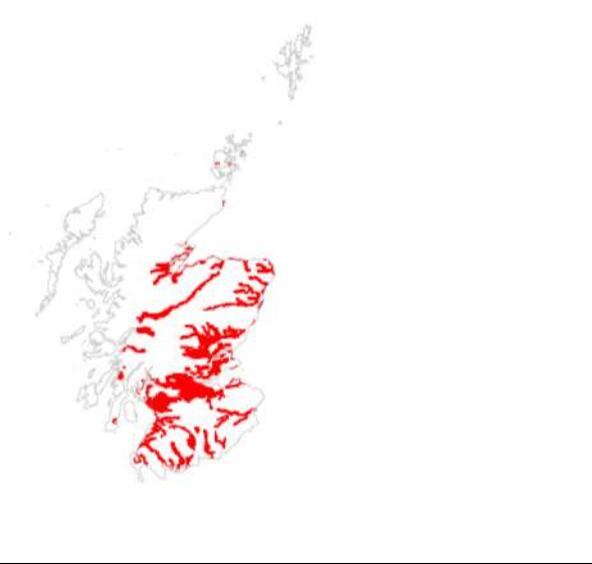
Various datasets have been collected by project partners that may offer more up to date position of the shoreline. These include the Scottish Government acquired LiDAR Phase1 survey amongst others. Through liaison with the OS, this project aims to investigate the possibility of revising the OS's high water mark where possible. This would enable the most up-to-date shoreline to be used for the assessment, but also ensures OS products consume these revisions.

### 2.5.1 LiDAR Phase 1

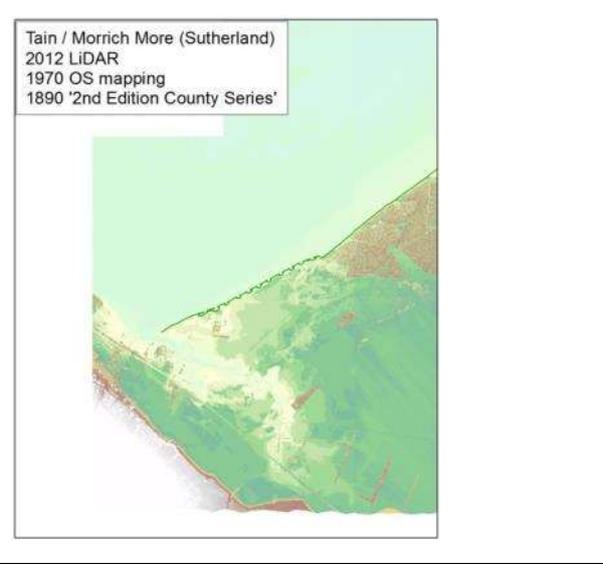
The Scottish Government commissioned a LiDAR survey in 2011/2012, which covered large amounts for flood-prone areas of Scotland. Discussions regarding the copyright of these datasets have concluded recently and the data is available via the One Scotland Mapping Agreement.

Data Summary	Current mapping
Dataset name	LiDAR Phase1
Owner	The Scottish Government
Supplier	The Scottish Government
Copyright status	Open Government Licence
Contact	Alan Corbett (SG)
Extent	Partial Coverage
Scale	1m pixel
Epoch	2011 to 2012
Restrictions	None, viewable by public
Costs	None
Acknowledgement	Scottish Government

Map showing coverage



Map showing insert

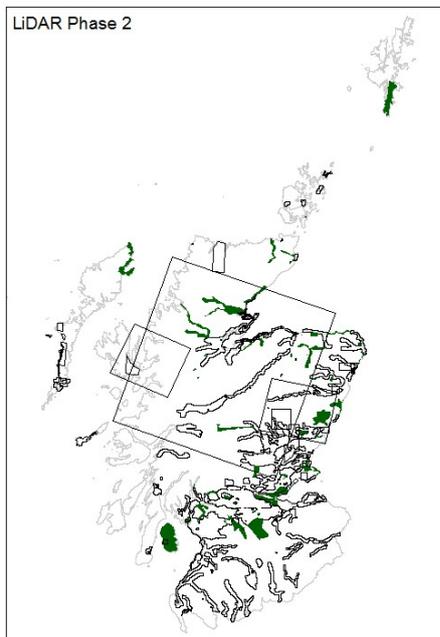


### 2.5.2 LiDAR Phase 2

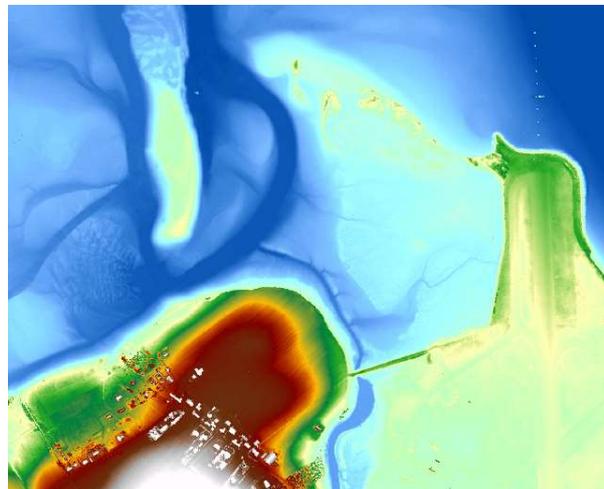
The Scottish Government commissioned a second LiDAR survey in 2013/2014, which extended the areas captured within Phase 1. At the time of writing the Scottish Government is in discussions with the copyright owner, with regard to open access. At present however the data is covered by the One Scotland Mapping Agreement and freely available within the Scottish Public Sector.

Data Summary	Current mapping
Dataset name	LiDAR Phase 2
Owner	The Scottish Government
Supplier	The Scottish Government
Copyright status	One Scotland Mapping Agreement
Contact	Alan Corbett (SG)
Extent	Partial Coverage
Scale	1m pixel
Epoch	2013
Restrictions	Viewable by public sector
Costs	None
Acknowledgement	OSMA

Map showing coverage



Map showing insert





### 2.5.4 HES Terrestrial Laser Scan

Historic Environment Scotland commissioned a Terrestrial Laser Scan have been analysed at Skara Brae (Bay of Skail, Orkney) in 2014 & 2016.

Data Summary	HES TLS
Dataset name	HES Skara Brae
Owner	HES
Supplier	HES
Copyright status	Licensed
Contact	Lyn Wilson (HES)
Extent	Skara Brae
Scale	Downsampled to 1m pixel
Epoch	2014 and 2016
Restrictions	Viewable by public bodies, with permission from HES
Costs	None
Acknowledgement	HES
<p>Map showing coverage</p> 	<p>Map showing insert</p> 

### 2.6 Update of the OS MasterMap MHWS line

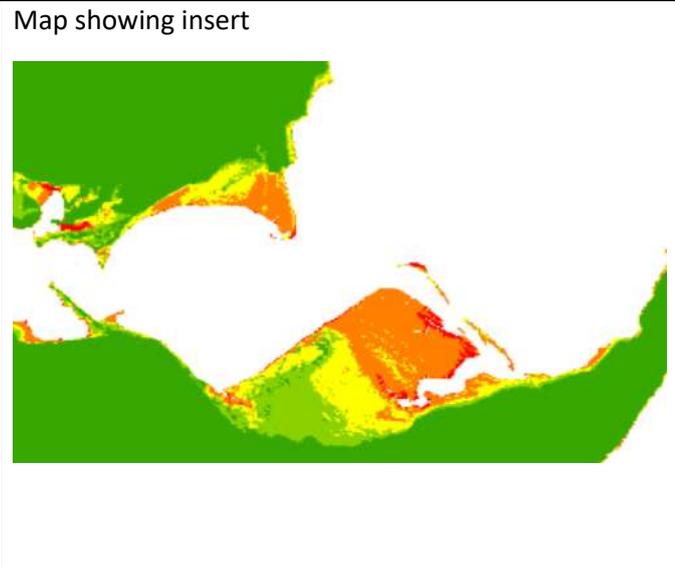
Update from OS is forthcoming.

## 2.7 Coastal Erosion Susceptibility Model

The Coastal Erosion Susceptibility Model has various input datasets. Whilst most of these have been selected in part due to their open-license the geological data does come with restrictions.

### 2.7.1 Digital Terrain Model

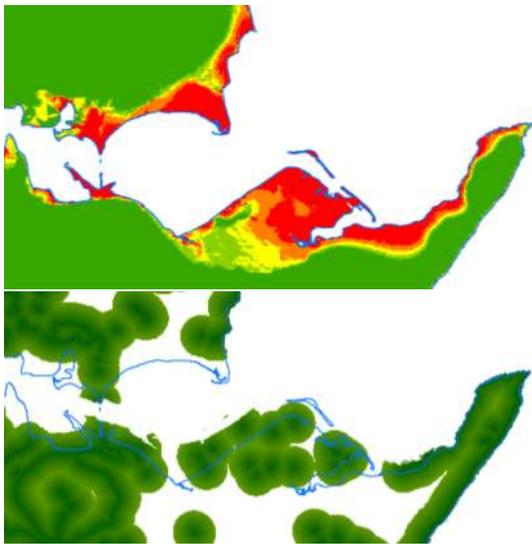
The DTM used with the CESM has been sourced from OS Terrain 50 (OST50 DTM). THE OST50 DTM describes the ground elevation relative to OD derived from aerial photography in the form of a 50 pixel raster. The OST50 DTM is released as part of OS OpenData initiative and is therefore freely available for use. The accuracy of the OST50 DTM was tested by the OS by comparing the DTM to know GPS data. This resulted in a root mean square error (RMSE) of 1.5 m in urban areas, and 2.5 m in rural areas and mountainous and moorland regions. Further information is available at: <http://www.ordnancesurvey.co.uk/business-and-government/products/terrain-50.html>

Data Summary	Digital Terrain Model	
Dataset name	OS Terrain 50 DTM	
Owner	OS	
Supplier	OS	
Copyright status	Open Source	
Contact	N/A	
Extent	National	
Scale	50 m pixel	
Epoch	2013	
Restrictions	None, viewable by public bodies	
Costs	None	
Acknowledgement	OS	
Map showing coverage	Map showing insert	
		

### 2.7.2 Rockhead altitude

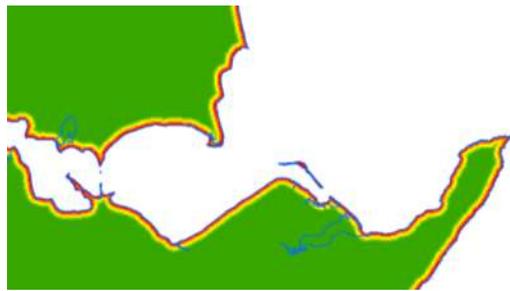
The CESM uses the Rockhead output from the British Geological Survey (BGS) Superficial thickness model. This dataset is a 50m pixel raster dataset for the country which identifies the thickness of superficial sediments. This has been aligned with the Ordnance Survey's open source OST50 DTM describing the ground elevation. By subtracting the thickness model from the elevation model, the altitude of rockhead is estimated.

The relative accuracy of this derived dataset will be discussed elsewhere, however despite variable confidence levels it remains a useful and necessary dataset within the CESM. The proximity to borehole data is also required.

Data Summary	Rockhead
Dataset name	Superficial Thickness Model - Rockhead Output
Owner	British Geological Survey
Supplier	British Geological Survey
Copyright status	Released under Letter of Understanding
Contact	Rob Smith (BGS)
Extent	National
Scale	50 m pixel
Epoch	NA
Restrictions	Derived data is used within NCCA
Costs	None
Acknowledgement	© BGS
<p data-bbox="204 1368 485 1397">Map showing coverage</p> 	<p data-bbox="799 1368 1390 1435">Map showing insert (top: categorised rockhead &amp; bottom: relative confidence)</p> 

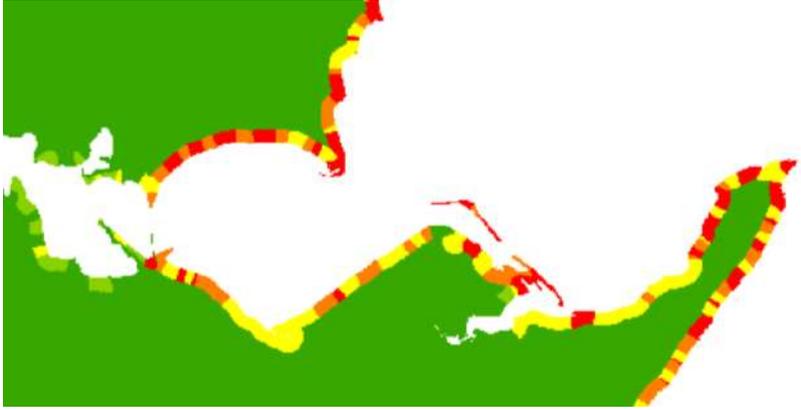
### 2.7.3 Distance from open coast

This parameter within the CESM was generated using the OS Mastermap MHWS data. Using GIS, coastal inlets that were less 500 m in width at the coast were removed from the data, and effectively the coastline data was smoothed at specific locations. This was necessary as where the inlet width narrowed and shallowed sufficiently to cause attenuation of wave activity a reduction in coastal erosional susceptibility would occur. The smoothing process created a polyline which represented the 'open coast' i.e. the areas where wave action is most prevalent resulting in elevated susceptibility to erosion

Data Summary	Distance from Open Coast	
Dataset name	Distance from Open Coast	
Owner	Derived from OS MasterMap	
Supplier	OS	
Copyright status	©OS	
Contact	Lachlan Rennick	
Extent	National	
Scale	1:10,000	
Epoch	2011	
Restrictions	None	
Costs	None	
Acknowledgement	OS via OSMA	
Map showing coverage	Map showing insert	
		

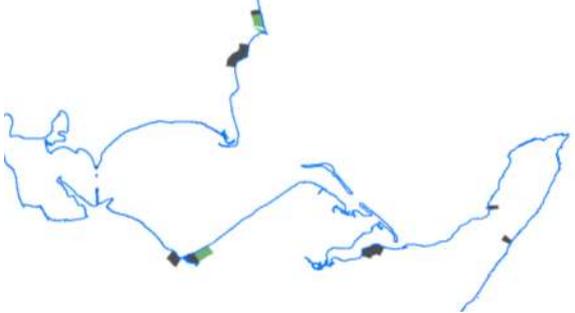
### 2.7.4 Wave exposure index

The wave exposure data was generated from the fetch data used originally by Ball et al. (2008) which was itself based upon a methodology devised by Burrows et al. (2008). The data consist of a 200 m raster along the Scottish coastline with a non-dimensional index value (range from 2 to 800) which takes into account wave fetch and wind exposure.

Data Summary	Wave exposure
Dataset name	Wave Exposure
Owner	Open Source
Supplier	OS Open Source data
Copyright status	Open Source
Contact	University of Glasgow
Extent	National
Scale	200 m pixel
Epoch	n.a.
Restrictions	None, viewable by public bodies
Costs	None
Acknowledgement	University of Glasgow
Map showing coverage 	Map showing insert 

### 2.7.5 Coastal defences

The NCCA updated the coastal defence dataset from EUrosion (2004) which in turn was updated by SNH (and in part) by Halcrow (2011). Using OSMA aerial imagery it has been possible to collate information of 'Hard' (seawalls, embankments, revetments, nearshore breakwaters, rock armour, and gabion baskets) and 'Soft' (groynes, beach nourishment projects, and slope stabilisation works) coastal defences around Scotland. In addition to the earlier data, expert knowledge has been used to update information where necessary.

Data Summary	Coastal Defences	
Dataset name	Defences	
Owner	Scottish Government	
Supplier	Scottish Government	
Copyright status	Open Government Licence	
Contact	Alan Corbett (SG)	
Extent	National	
Scale	1:10,000	
Epoch	2004 to 2014	
Restrictions	None, viewable by public bodies	
Costs	None	
Acknowledgement	SG via OSMA	
Map showing coverage	Map showing insert	
		

### 2.7.6 Coastal accretion

The NCCA updated the coastal accretion dataset from Using the EUrosion (2004) which in turn was data which was updated by SNH (and in part) by Halcrow (2011). Using OSMA aerial imagery it has been possible to collate information where coastal sediment was accumulating. In addition to the earlier data, expert knowledge has been used to update information where necessary.

Data Summary	Coastal Accretion	
Dataset name	Defences	
Owner	Scottish Government	
Supplier	Scottish Government	
Copyright status	Open Government Licence	
Contact	Alan Corbett (SG)	
Extent	National	
Scale	1:10,000	
Epoch	2004 to 2014	
Restrictions	None, viewable by public bodies	
Costs	None	
Acknowledgement	SG via OSMA	
Map showing coverage	Map showing insert	

## References

Ball, T., Werritty, A., Duck, R. W., Edwards, A., Booth, L., & Black, A. R. (2008) Coastal Flooding in Scotland: A Scoping Study. Report to the Scotland and Northern Ireland Forum for Environmental Research (SNIFFER) no. FRM10.,

Burrows, M., Harvey, R. & Robb, L. (2008). Wave exposure indices from digital coastlines and the prediction of rocky shore community structure. *Marine Ecology Progress Series*, 353(Thomas 1986), pp.1–12. Available at: <http://www.int-res.com/abstracts/meps/v353/p1-12/> [Accessed February 1, 2013].

EUrosion, (2004) EUrosion baseline for Scotland: SNH Update., Available at: <http://www.euroSION.org>.

Halcrow, (2011) Work Package 3 Report: An assessment of the vulnerability of Scotland's river catchments and coasts to the impacts of climate change, Exeter, UK.



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