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Dynamic Coast - National Coastal Change Assessment: Cell 11 - Shetland

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National Coastal Change Assessment
Steering Committee

Coastal Change & Vulnerability Assessment

Dynamic Coast – Scotland's National Coastal Change Assessment

Executive Summary

- Cell 11 covers the Shetland Islands.
- The length of Mean High Water Springs in Cell 11 has been calculated at 2,621 km which makes up 13% of the Scottish coastline. Of this, length, 91% has been categorised as hard and mixed, 8% (212 km) as soft and 1% (19km) as artificial.
- Within the historical period 1890-1970s (74 years), most of the soft shoreline has not changed significantly (75%), accretion (advance) has occurred along 25% of soft coasts with retreat (erosion) occurring along 1%.
- The period from the 1970s to modern spans 37 years, so the historical period data has been normalised to 37 years to allow comparisons with the modern period.
- When this adjustment is applied, the extent of retreat (erosion) increased from 1% historically to 3% post 1970s, the extent of stability increased from 88% to 95% and the extent of advance (accretion) decreased from 12% to 0.5%.
- In addition to the changes in the extents of erosion and accretion in Cell 11, there has been a marginal increase in the rate of erosion (retreat), and a small decrease in the rate of advance (accretion).
- This trend suggests there may have been a shift in the status of soft coast of cell 11 in the modern period from a bias of accretion toward an erosional bias.
- For much of Shetland, the position of the MHWS line has not been accurately resurveyed since the 1970s and so the 2014 Ordnance Survey (OS) line, which is plotted to closely match the 1970s line, is inaccurate.

Disclaimer

The evidence presented within the National Coastal Change Assessment (NCCA) must not be used for property level of scale investigations. Given the precision of the underlying data (including house location and roads etc.) the NCCA cannot be used to infer precise extents or timings of future erosion.

The likelihood of erosion occurring is difficult to predict given the probabilistic nature of storm events and their impact. The average erosion rates used in NCCA contain very slow periods of limited change followed by large adjustments during storms. Together with other local uncertainties, not captured by the national level data used in NCCA, detailed local assessments are unreliable unless supported by supplementary detailed investigations.

The NCCA has used broad patterns to infer indicative regional and national level assessments in order to inform policy and guide follow-up investigations. Use of these data beyond national or regional levels is not advised and the Scottish Government cannot be held responsible for misuse of the data.

Contents

Document Structure

This document outlines the Historical Change Assessments and Vulnerability Assessment for Scotland's soft coastline. The methodologies used within the NCCA are detailed in a separate report. The document is structured to conform to the Scottish coastal sediment cell and sub-cell boundaries that were first delimited by Ramsay and Brampton (2000) in a series of 11 reports. The concept of coastal cells as a science based management unit for the coast is based on a recognition that the processes that shape and alter the coast, while unrelated to administrative boundaries are related to changes in sediment availability and interruptions to that availability. As a management unit, the coastal cell can be seen to fulfil a similar function to that of a catchment area of a river for terrestrial flood management. Changes in erosion, accretion and sediment supply in one coastal cell are seen to be largely unrelated to, and unaffected by, conditions in adjacent coastal cells, and are therefore seen as self-contained in terms of their sediment movement. For example, at many sites net sediment movement is in one direction and may pass around a headland (the major cell boundaries) only in very small volumes. Within a cell, any engineering structures that interrupt alongshore sediment delivery on the updrift side of a coast may impact on the downdrift coast but not vice versa given the "one-way" nature of net sediment movement. As sediment sinks, estuaries might be suitable cell boundaries, however subdivision of an estuary where sediment may circulate freely between both banks is inconvenient and so the inner portions of major firths and estuaries have been defined as sub-cells (Ramsey and Brampton, 2000). Whilst the cell system is ideal from a scientific perspective, it remains that Local Authorities may straddle a cell boundary. The results and statistics for each Local Authority area and for Marine Planning Regions are contained in a separate report.

Commencing with a national overview, this report summarises key locations whose positions of Mean High Water Springs (MHWS) have changed between the periods 1890s to 1970s and 1970s to modern time, although the exact time of survey may vary slightly around those dates and between coasts. The locations are arranged within sub-cells, which progress around Scotland in an anticlockwise direction, followed by the Western Isles, Orkney and Shetland. A short narrative summarises the historical changes and current situation at each location, followed by a vulnerability assessment which considers the implications of assets adjacent to areas of erosion. This narrative is to allow the reader to appreciate the overall findings from the evidence on coastal changes. The report is concluded by a series of tables summarising the statistics for cell one. Each of the 11 coastal cells has a similar report to this, which sits alongside a national overview to collate the national picture and consider the implication for Scotland's coastal assets. Where appropriate, mention is made of the existence of a shoreline management plan for a particular section of coast.

The full results of each cell are available on the webmaps (www.dynamiccoast.com) and have been designed to be highly accessible. Within the webmaps the user can navigate across the whole country, display various shorelines and click on each of the shorelines, to quantify the changes.

The National Context

For a full national overview of the aims, methodology, characteristics and underlying factors that control Scotland's coastline, the reader is directed to the National Overview report where a Whole Coast Assessment and results from the historical and recent changes are presented. Here only a short summary of the national changes identified are presented to place this individual coastal cell report into context.

Since the 1970s, 12% of the soft coast length across Scotland has retreated landwards (erosion), 11% has advanced seawards (accretion) and 77% stable or has shown insignificant change (Figure 1). National comparisons from the historical period (1890 to 1970) to recent period (1970-modern), accounting for the different time periods, show an increasing proportion of erosion (8% to 12%), similar stability (from 78% to 77%) and falling accretion (14% to 11%). Where coastal changes occur, they are faster than before. Nationally, average erosion rates after the 1970s have doubled to 1.0 m/yr whilst accretion has almost doubled to 1.5 m/yr.

The national pattern is an aggregation of different results from different parts of the country (Figure 2). The more exposed mainland east coast cells (1,2,3) and Solway Firth (7) have greater proportions of soft coast erosion and accretion (i.e. significant change) and lower proportions of stability. On the rock-dominated cells (for example cells 8,9,10, 11), soft coast stability is far higher and the extent of erosion and accretion lower. Whilst the natural level of protection offered to the soft sections of coast by the surrounding rocky coast has not changed through time, the proportion of soft coast experiencing erosion and accretion has. Considering the changes through time, the exposed coastal cells of the east coast have seen greater increases in change, with more modest changes occurring on the rock-dominated cells.

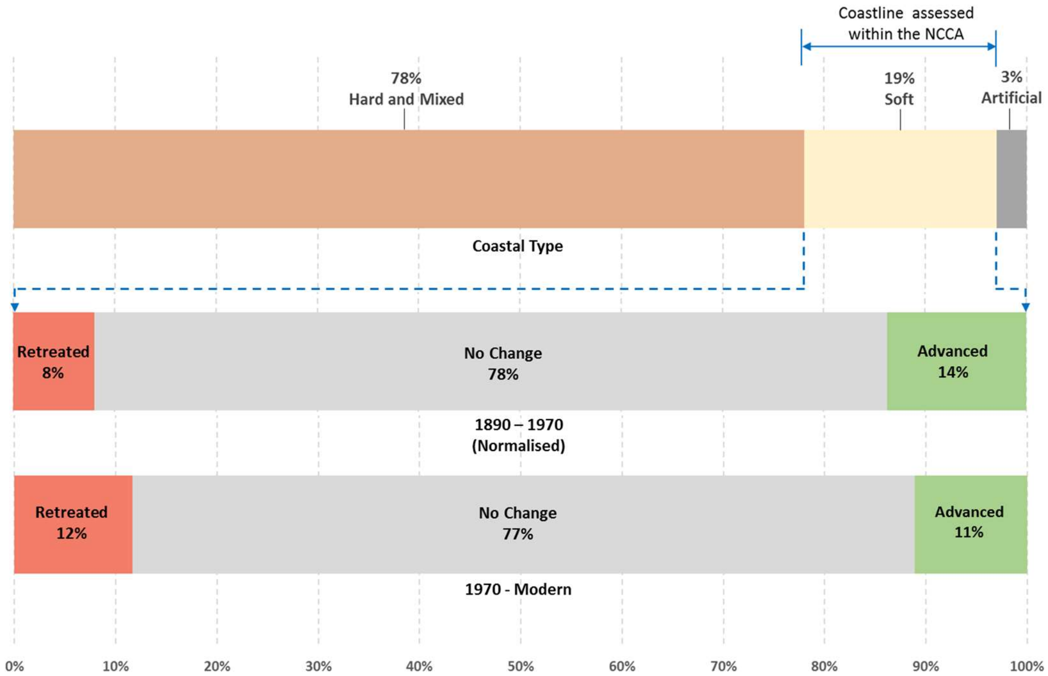

Figure 1: National coastal change results showing the proportion of soft coast retreating, stable and advancing within each change category in the historical (ca. 1890-1970 normalised for time period) and recent (ca. 1970-Present) time periods.

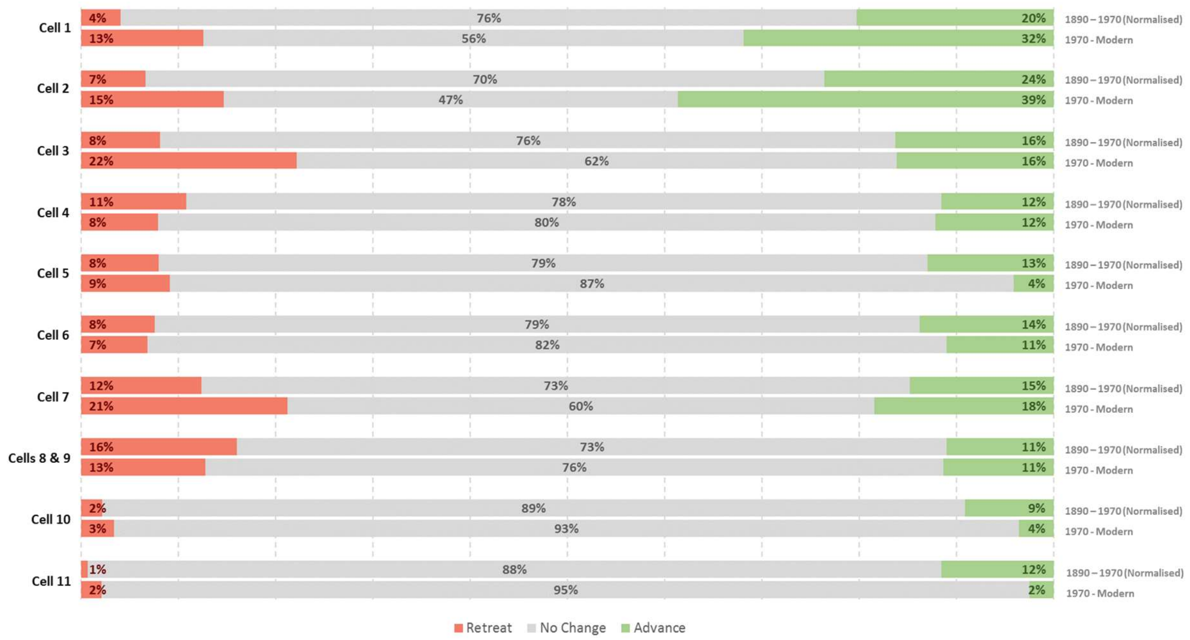

Figure 2: National coastal change results showing historical (ca. 1890-1970, normalised for time period) and recent (ca. 1970 Present.) % of coastal cell showing retreat (red), stability (grey) and advance (green) for soft coast within each cell.

Two other trends are worthy of mention here. The first relates to the propensity for the outer coast to be more exposed to wave impact than the inlets, bays and firths of the inner coast and so the potential for wave-driven erosion is greater along the outer coast. This is exacerbated by a reduction in sediment supply to the outer coast from the higher levels experienced a few thousand years ago. These outer coasts constantly lose sediments to inlet infilling via longshore drift (currents that transport sediment from a source area updrift to an accepting area downdrift). As such, erosion has progressively become the dominant trend on the outer coast in all places except where the import of longshore drift sediments feeds downdrift beaches. Conversely inlets, embayments and firths are sediment sinks that accept soft coastal sediments derived from erosion of the outer coast (the sediment sources) in addition to sediment freshly delivered by rivers. The result is that whilst the inner coast has a bias toward accretion, the outer coast, hard or soft, has a bias toward erosion.

A second trend is the close coincidence between coastal defences and erosion of the adjacent coast. Unsurprisingly, the insertion of defences is in response to a coastal erosion or flooding event, yet there are many instances where the defences themselves have exacerbated the pre-existing erosional condition, either on-site or on adjacent coastline downdrift. The reasons are three-fold. First, a defence structure is aimed at halting or slowing an existing erosion condition and so a successful structure not only halts erosion but also the supply of eroded sediment that had previously reached the fronting beach. The result is a reduced sediment supply and beach lowering. Second, most structures reflect wave energy and, indirectly, sediment leading to beach lowering. Third, the insertion of a defence structure on a coast that is affected by longshore currents not only prevents the supply of sediment to the fronting beach, it also reduces the supply of sediment previously exported leading to downdrift beach lowering and erosion.

Cell 11 – Shetland

Cell 11 includes the Shetland Isles, with the sub cell boundaries shown in Figure 11.1. Much of the coast of Shetland is cliff and rocky and, in general, soft coastal landforms are infrequent. However, where they do occur they tend to be valuable assets for the local communities for ease of access to the coast for recreational purposes and are key tourist assets. Further contextual information about the processes operating in Cell 11 can be found in Ramsay & Brampton (2000).

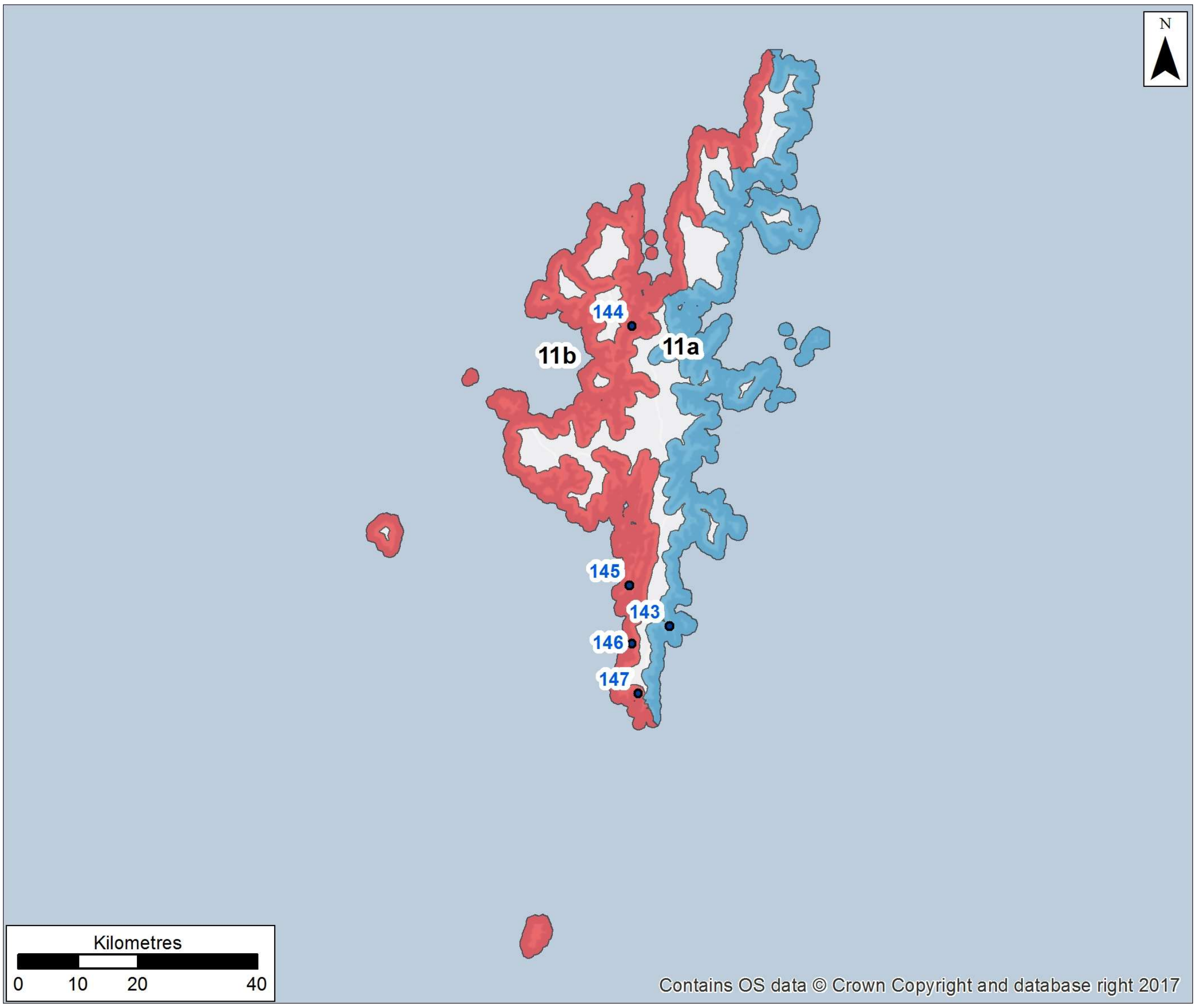

Figure 11.1: The sub-cell boundaries of Cell 11.

Physical Overview

The length of Mean High Water Springs (MHWS) in Cell 11 has been calculated at 2,621 km which makes up 13% of the Scottish coastline. Of this length, 91% has been categorised as hard and mixed, 8% (212 km) as soft and 1% (19km) as artificial (Table 11.1). Within the historical period (1890-1970s, 74 years) most of the soft shoreline had not changed significantly (75%), accretion (advance) had occurred along 25% of soft coasts with erosion (retreat) occurring along 1% (Figure 11.2). The period from the 1970s to modern spans 37 years, so the historical period data has been normalised to 37 years to allow comparisons with the modern period.

When this adjustment is applied the extent of erosion increased from 1% historically to 3% post 1970s, the extent of stability increased from 88% to 95% and the extent of accretion decreased from 12% to 0.5% (Figure11.2). In addition to the changes in the extents of erosion and accretion in Cell 11, there has been a marginal increase in the rate of erosion (retreat), and a small decrease in the rate of advance (accretion). This trend is consistent with a move from accretion (reducing), through a transitional condition of no change (increasing), toward erosion (increasing) with the average rate of erosion increasing from the historical to the recent period. Further statistics for Cell 11 can be found in Table 11.2 and Table 11.3 at the end of this report.

It should be noted that for much of Shetland, the position of the MHWS line has not been accurately resurveyed since the 1970s and so the 2014 Ordnance Survey (OS) line, which is plotted to closely match the 1970s line, is inaccurate. Only a small number of locations have LiDAR or other Digital Surface Models available to update MHWS.

Table 11.1: Proportion of each coastal type within Cell 11.

Modern Coastal Type	Length	
	km	%
Soft	211.7	8%
Artificial	18.5	1%
Hard and Mixed	2391.0	91%
Total Length (excluding tidally influenced inlets)	2621.2	100%

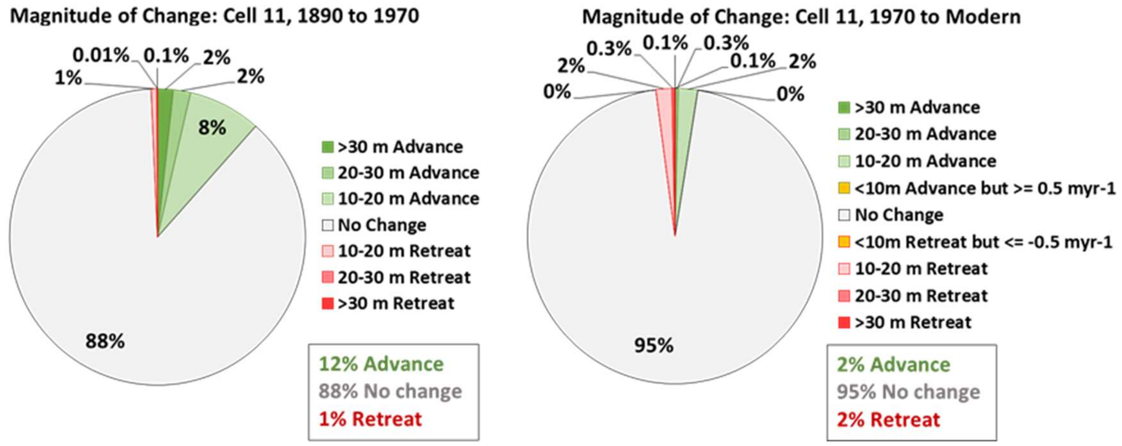

Figure 11.2: Coastal change results for Cell 11 showing the proportional amount of change in the historical (ca. 1890-1970 normalised) and recent (ca. 1970-Present) periods. Rounding errors may produce small % differences between Figure 2 and Figure 11.2.

Asset Vulnerability Overview

The Vulnerability Assessment methodology serves to project the known past erosion rates forward into the future to the year 2050 and is viewable on the online webmaps at www.dynamiccoast.com. Within Cell 11, a total land area of 1.0 ha, which supports various assets, is anticipated to be lost by 2050. No residential or non-residential properties within the areas expected to be eroded by 2050. When areas that erosion many influence are included, again no residential or non-residential property are anticipated to be affected by 2050. For a full summary of vulnerable assets see Table 11.4 at the end of this report.

Sub-cell Summaries

Subcell 11a - Sumburgh Head to Herma Ness (Shetland East)

11a.1 Sandwick (Site 143)

Historic Change: The bayhead at Sandwick appears relatively sheltered. Nevertheless, the shore face at the eastern part of the village has undergone recession between 1973 and 2013 of 9 m over 120 m of shore to the east of the settlement, with the village access road to Noness being within 13 m of the MHWS of 2013 (Figure 11.3). The beach here is composed of coarse gravels that may have been augmented with boulders for added protection.

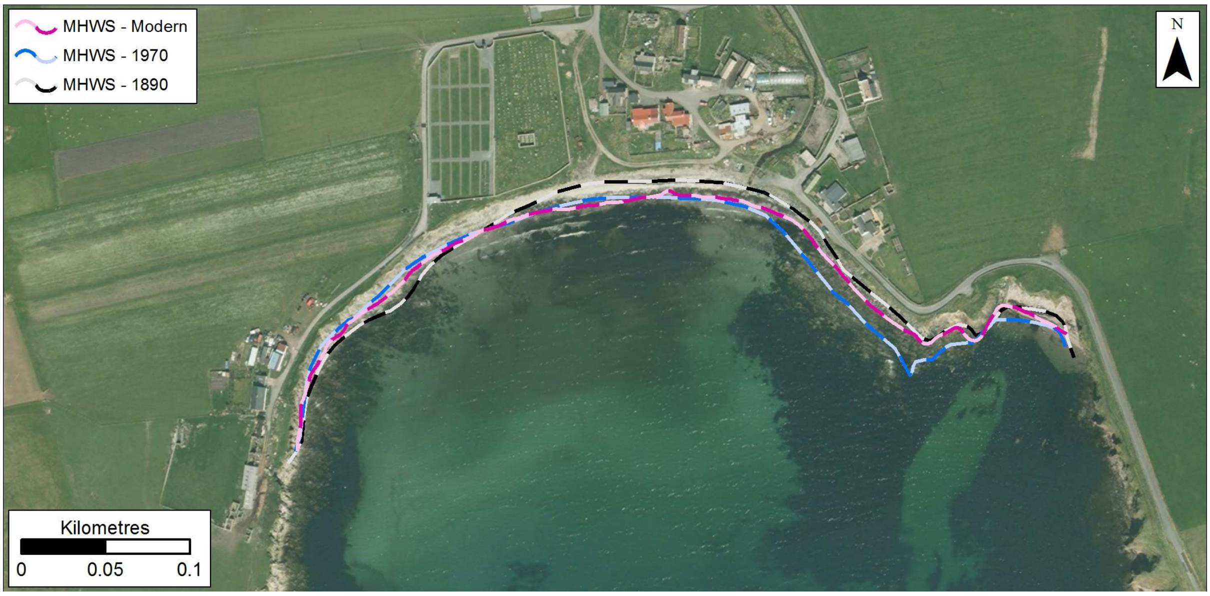

Figure 11.3: MHWS position in 1890, 1970s, and Modern datasets at Sandwick. Getmapping are our current providers of Scotland-wide digital aerial imagery© Getmapping plc.

Figure 11.4: Possible future coastline position in 2050 based on rates between 1970 and Modern MHWS data at Sandwick. Getmapping are our current providers of Scotland-wide digital aerial imagery© Getmapping plc.

Future vulnerability: The area of future erosion anticipated by 2050 covers 40 m of the shore and impinges on 25 m of the access road to the rear. The erosion vicinity affects two houses and their outbuildings to the landward side of the road (Figure 11.4).

11a.2 Sullom Voe (Site 144)

Historical Change: Three small areas of erosion totalling 800 m of coast with up to 14 m of recession between 1982 and 2013 have occurred on the headland to the west of the Sullom Voe terminal in an area of undeveloped land at Fugla Ness (Figure 11.5).

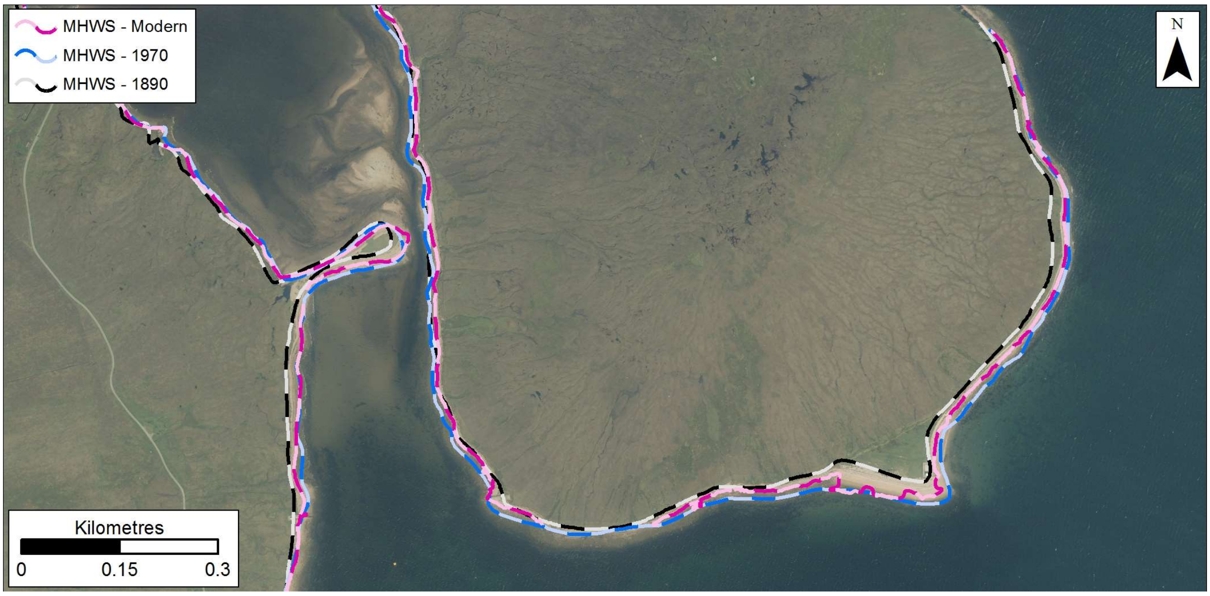

Figure 11.5: MHWS position in 1890, 1970s, and Modern datasets at Sullom Voe. Getmapping are our current providers of Scotland-wide digital aerial imagery© Getmapping plc.

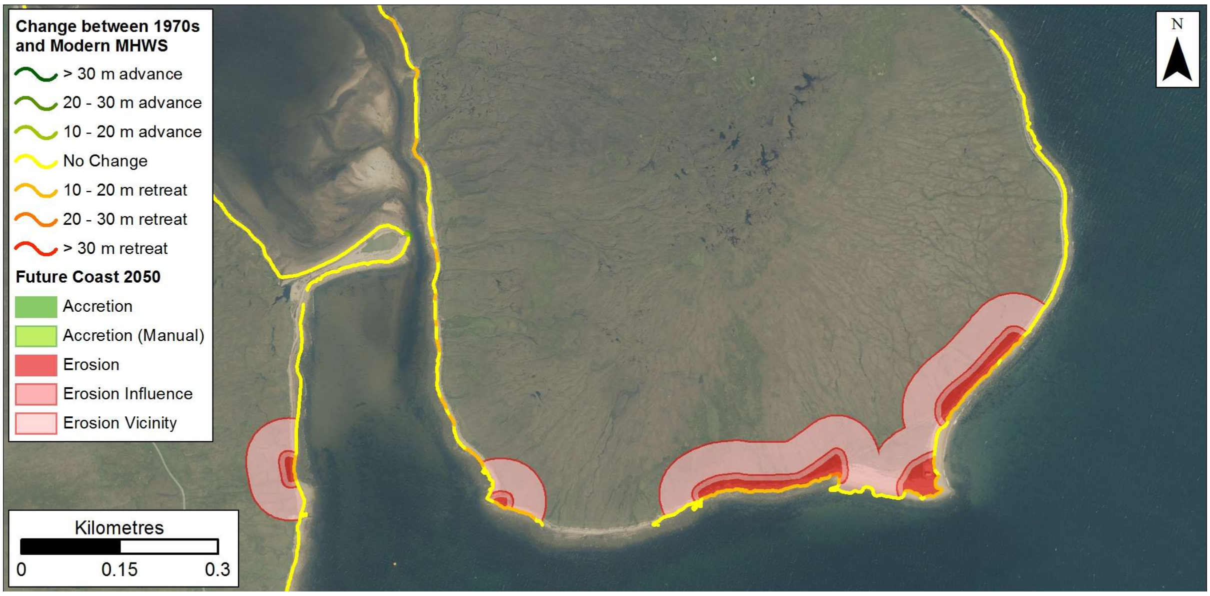

Figure 11.6: Possible future coastline position in 2050 based on rates between 1970 and Modern MHWS data at Sullom Voe. Getmapping are our current providers of Scotland-wide digital aerial imagery© Getmapping plc.

Future vulnerability: The area of future erosion anticipated by 2050 covers an area of largely glacial till that accounts for its recession rate. Since the coastline rises inland, the vulnerability to erosion is low, although there are some derelict piers in the area that may be lost (Figure 11.6). No access roads lead to these piers, nor are there built assets nearby.

Subcell 11b - Herma Ness to Sumburgh Head (Shetland West)

11b.1 Banna Minn (Site 145)

The tombolo at Banna Minn lies at the head of West Voe and has undergone recession of MHWS between 1970 and 2013 of up to 17 m on its southern side and up to 10 m on its northern side. This has resulted in a narrowing of the feature to as little as 5 m (Figure 11.7). Although the land is given over to pasture, the tombolo is the only land connection to the much larger grazing area of Kettla Ness. As a result, about 80 m of the beach on both side has been augmented with boulders to slow the rate of erosion.

Figure 11.7: MHWS position in 1890, 1970s, and Modern datasets at Banna Minn. Getmapping are our current providers of Scotland-wide digital aerial imagery© Getmapping plc.

Future vulnerability: Whilst the future look to 2050 suggests that erosion is anticipated on the land to the east of where the tombolo narrows, the viability of the tombolo is under threat over its entire length (Figure 11.8). Although the area has no built assets and only a rough farm track across to Kettla Ness area, the tombolo is anticipated to be vulnerable by 2050, as is the access to the grazing land to the west on the Kettla Ness peninsula.

Figure 11.8: Possible future coastline position in 2050 based on rates between 1970 and Modern MHWS data at Banna Minn. Getmapping are our current providers of Scotland-wide digital aerial imagery© Getmapping plc.

11b.2 St. Ninian's Isle (Site 146)

Historical Change: Between 1970 and 2013, the tombolo at St. Ninian's has remained approximately stable, although this conceals subtle changes in the north and south facing arcs. The north has seen accretion of up to 20 m dominate over the whole beach. The south arc has been stable except for 140 m of the west end where 15 m of erosion has occurred (Figure 11.9). The 2013 MHWS in the north also shows a large deviation, likely to be the result of an overwash event that occurred just before the 2013 survey was undertaken. The Isle is an important tourist and recreational asset that is visited by thousands every year and so stabilisation and dune planting works on the mainland side have been undertaken over the years. Despite this, the main access to the beach is prone to wind deflation.

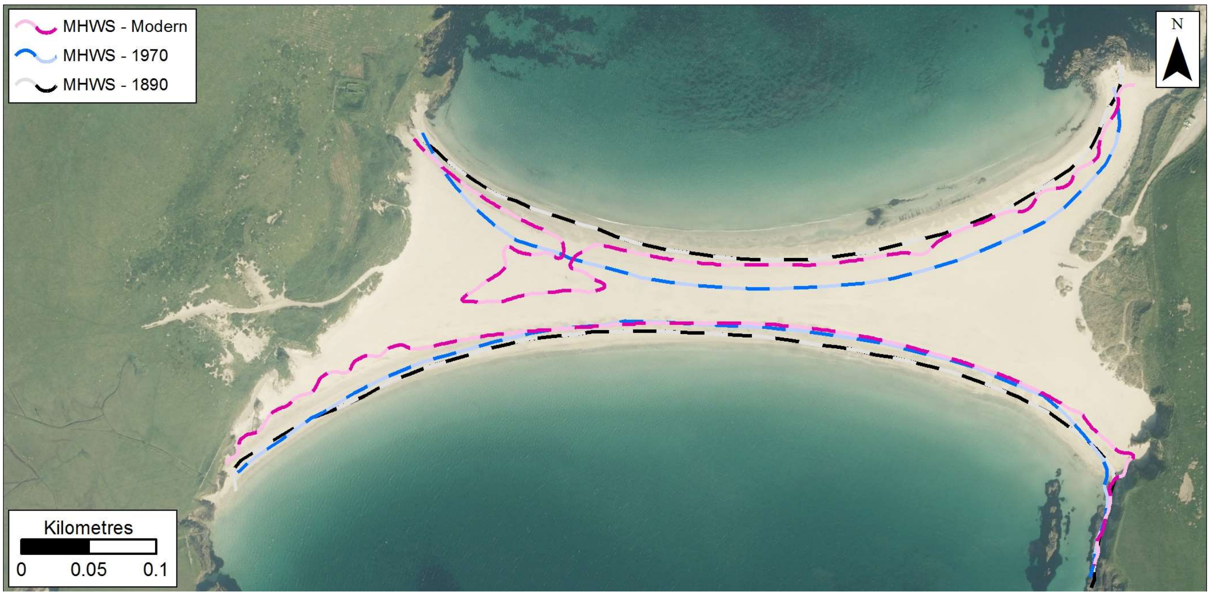

Figure 11.9: MHWS position in 1890, 1970s, and Modern datasets at St. Ninian's Isle. Getmapping are our current providers of Scotland-wide digital aerial imagery© Getmapping plc.

Future vulnerability: Whilst the future look to 2050 does not suggest any major areas of concern at St. Ninian's, it remains that the future resilience of the tombolo depends on a continued sediment supply. It is possible that the tombolo is still adjusting from the extensive sand mining activities (now stopped) that occurred up to and beyond the 1970s in the dune system on the mainland side. Prior to sand mining, the dunes would have acted as a sediment store serving to release sediment back to the tombolo during high energy wave events (Figure 11.10).

Figure 11.10: Possible future coastline position in 2050 based on rates between 1970 and Modern MHWS data at St. Ninian's Isle. Getmapping are our current providers of Scotland-wide digital aerial imagery© Getmapping plc.

11b.3 Sumburgh West Voe (Site 147)

Historical Change: At Sumburgh West Voe between 1970 and 2013, the beach has either accreted or remained stable except in the extreme south where up to 15 m of erosion has occurred over a length of about 40 m (Figure 11.11). A short stretch of wall at the end of the eroding section may well be the reason for this flanking erosion, since the rest of the beach is unprotected and stable. The beach is backed by a high sand dune that has been strengthened on its landward (airport) central side by a 2.5 m high concrete wall for about 300 m along the perimeter access road to Sumburgh Airport. The purpose of the wall is more to restrict the inundation of sand onto the road, rather than for any coast protection function. Its design would be unsuitable for a coast protection function if impacted by waves in the future. The east beach to the west of Grutness has remained relatively stable between 1970 and 2003.

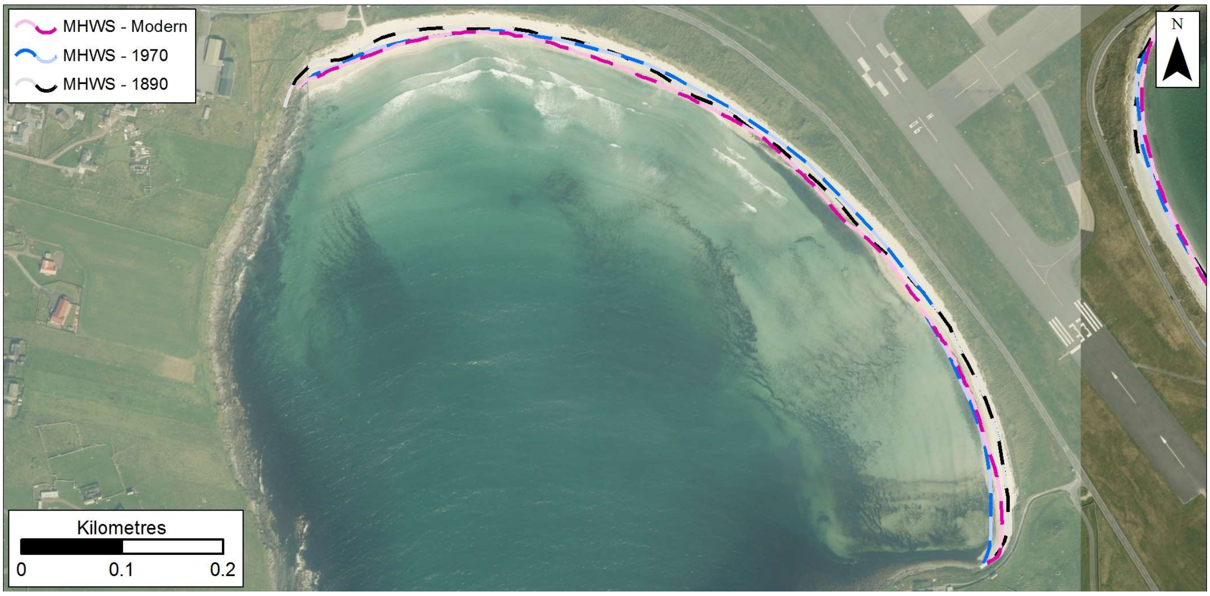

Figure 11.11: MHWS position in 1890, 1970s, and Modern datasets at Sumburgh West Voe. Getmapping are our current providers of Scotland-wide digital aerial imagery© Getmapping plc.

Vulnerability Assessment: The vulnerability assessment projects the erosion rate that has occurred on the soft coast since the 1970s forward to 2050 and 2100. The recent erosion at the south end of Sumburgh west beach places this area into an eroding zone by 2050, with a 15m stretch of farm access road also lying within the eroding zone (Figure 11.12). The wider erosion vicinity comes very close to the perimeter access road to the airport that skirts the main north-south runway. It also affects part of the beach and dune lying beyond the concrete wall that has been constructed to defend the runway from sand incursion from the rear of the dune. Unless the stability that the beach has enjoyed in the past becomes reversed by an increase in erosion, then the vulnerability of the beach at Sumburgh West Voe beach is anticipated to be low.

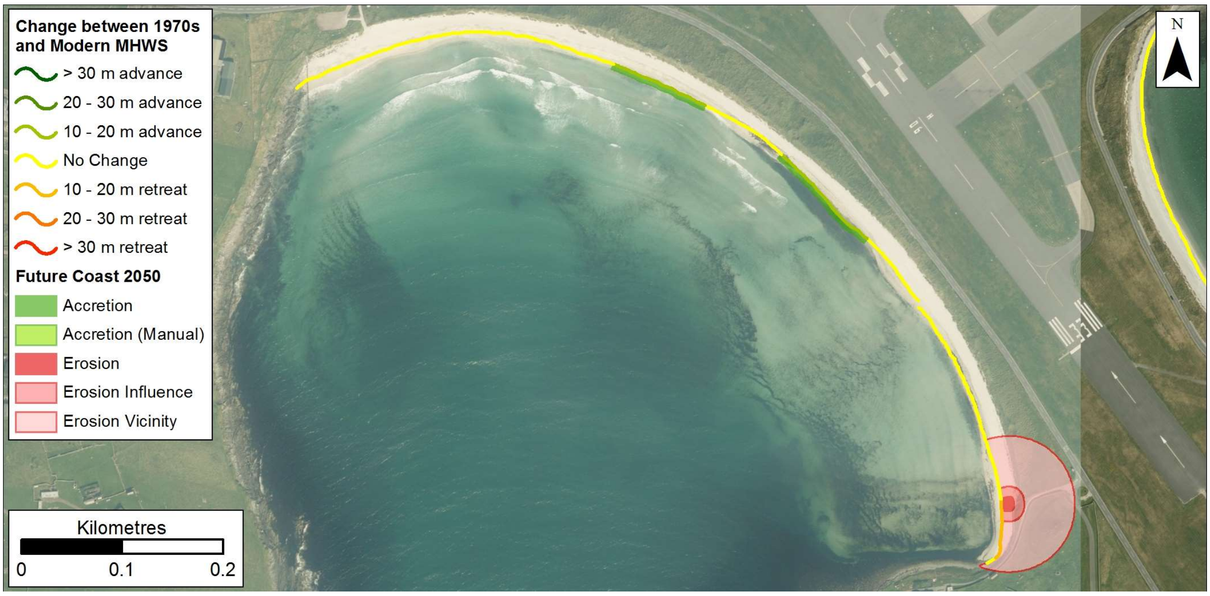

Figure 11.12: Possible future coastline position in 2050 based on rates between 1970 and Modern MHWS data at Sumburgh West Voe. Getmapping are our current providers of Scotland-wide digital aerial imagery© Getmapping plc.

Coastal Change Statistics for Cell 11

Within the soft sections of Cell 11, **24%** has been **advancing** between **1890 and 1970**; compared with **3%** between **1970 and modern data**.
Within the soft sections of Cell 11, **1%** has been **retreating** between **1890 and 1970**; compared with **2%** between **1970 and modern data**.
Within the soft sections of Cell 11, the **average rate of advance** is **0.3 m/yr** between **1890 and 1970**, and **0.4 m/yr** between **1970 and modern data**.
Within the soft sections of Cell 11, the **average rate of retreat** is **-0.2 m/yr** between **1890 and 1970**, and **-0.4 m/yr** between **1970 and modern data**.
Within the soft sections of Cell 11, **75%** has **not changed** significantly between **1890 and 1970**; compared with **95%** between **1970 and the modern data**.

Table 11.2: A summary of the average rates, average change distances, and lengths of advance, retreat, and no change within sub-cells of Cell 11.

Coastal Cell	Overall change (1)			Advance (2)			Retreat (3)			Insignificant change (4)		
	Average 1890 to 1970 Change on Soft Coast (m)	Average 1890 to 1970 Change Rate on Soft Coast (m/year)	Length of Soft Coast (km)	Average 1890 to 1970 Soft Coast Advance (m)	Average 1890 to 1970 Advance Rate on Soft Coast (m/year)	Length of Soft Coast Advance (km)	Average 1890 to 1970 Soft Coast Retreat (m)	Average 1890 to 1970 Retreat Rate on Soft Coast (m/year)	Length of Soft Coast Retreat (km)	Average 1890 to 1970 Soft Coast Insignificant Change (m)	Average 1890 to 1970 Retreat Rate on Soft Coast (m/year)	Length of Soft Insignificant Change (km)
Sub-cell 11a	6.1	0.08	112.9	18.6	0.26	23.4	-15.0	-0.21	1.7	3.2	0.04	87.8
Sub-cell 11b	10.0	0.14	97.2	26.7	0.37	27.2	-14.2	-0.20	1.3	3.9	0.05	68.8
Cell 11	7.9	0.11	210.2	23.0	0.32	50.6	-14.6	-0.21	3.0	3.5	0.04	156.6
	-	-	-	-	-	24.1%	-	-	1.4%	-	-	74.5%

Coastal Cell	Overall change			Advance			Retreat			Insignificant change (4)		
	Average 1970 to Modern Change on Soft Coast (m)	Average 1970 to Modern Change Rate on Soft Coast (m/year)	Length of Soft Coast (km)	Average 1970 to Modern Soft Coast Advance (m)	Average 1970 to Modern Advance Rate on Soft Coast (m/year)	Length of Soft Coast Advance (km)	Average 1970 to Modern Soft Coast Retreat (m)	Average 1970 to Modern Retreat Rate on Soft Coast (m/year)	Length of Soft Coast Retreat (km)	Average 1970 to Modern Soft Coast Insignificant Change (m)	Average 1970 to Modern Retreat Rate on Soft Coast (m/year)	Length of Soft Insignificant Change (km)
Sub-cell 11a	0.1	0.00	113.1	15.2	0.41	2.3	-15.4	-0.47	1.0	-0.1	0.00	109.8
Sub-cell 11b	-0.3	-0.01	98.7	15.5	0.36	3.0	-15.5	-0.41	3.5	-0.2	-0.01	92.2
Cell 11	-0.1	0.00	211.7	15.3	0.38	5.2	-15.4	-0.42	4.4	-0.2	0.00	202.0
	-	-	-	-	-	2.5%	-	-	2.1%	-	-	95.4%

1 Overall change shows the mean value for the whole cell / sub-cell, averaging gains and losses.
2 Advance shows the mean value for the shoreline gains, where there has been greater than 10 m of change, or change which is faster than 0.5 m/yr.
3 Retreat shows the mean value for the shoreline losses, where there has been greater than 10 m of change, or change which is faster than 0.5 m/yr.
4 Insignificant change shows the lengths of coastline which have changed less than 10 m.

NB: Avoid comparing distances of change (i.e. km) but rather use proportions (i.e. %) to avoid cartographic differences between the years.

Table 11.3: A summary of the length of change within each change distance category in the historical (ca. 1890-1970) and recent (ca. 1970-Present) time periods in Cell 11.

1890-1970	**Cell 11**		**Sub-cell 11a**		**Sub-cell 11b**	
	Length (km)	**Length (%)**	**(km)**	**(%)**	**(km)**	**(%)**
>30 m Advance	7.5	4%	2.5	1%	5.0	2%
20-30 m Advance	8.3	4%	2.6	1%	5.7	3%
10-20 m Advance	34.9	17%	18.4	9%	16.5	8%
No Change	156.6	75%	87.8	42%	68.8	33%
10-20 m Retreat	2.7	1%	1.5	1%	1.2	1%
20-30 m Retreat	0.2	0%	0.2	0%	0.1	0%
>30 m Retreat	0.1	0%	0.1	0%	0.0	0%
Total length	**210.2**	**100%**	**113.0**	**54%**	**97.2**	**46%**

Max advance (m)	243	Sullom Voe	135	243
Average change (m)	7.9		6.1	10.0
Max retreat (m)	-38	Sullom	-38	-24

1970-Modern	**Cell 11**		**Sub-cell 11a**		**Sub-cell 11b**	
	Length (km)	**Length (%)**	**(km)**	**(%)**	**(km)**	**(%)**
>30 m Advance	0.2	0%	0.1	0%	0.1	0%
20-30 m Advance	0.6	0%	0.3	0%	0.3	0%
10-20 m Advance	4.5	2%	1.9	1%	2.6	1%
<10m Advance but >= 0.5 myr^{-1}	0.0	0%	0.0	0%	0.0	0%
No Change	202.0	95%	109.8	52%	92.2	44%
<10m Retreat but <= -0.5 myr^{-1}	0.0	0%	0.0	0%	0.0	0%
10-20 m Retreat	3.7	2%	0.8	0%	2.9	1%
20-30 m Retreat	0.6	0%	0.2	0%	0.4	0%
>30 m Retreat	0.2	0%	0.0	0%	0.1	0%
Total length	**211.7**	**100%**	**113.0**	**53%**	**98.6**	**47%**

Max advance (m)	36.6	Heylor	34	37
Average change (m)	-0.1		0.1	-0.3
Max retreat (m)	-38	Sullom	-37	-38

Asset Vulnerability Statistics for Cell 11

Table 11.4: A summary of the number, length, or area of assets within the erosion, erosion influence, and erosion vicinity buffers of the future coastline projections for Cell 11.

Cell 11	Units	Modern to 2050				2050+			
		Erosion	Erosion Influence	Erosion Vicinity	Total	Erosion	Erosion Influence	Erosion Vicinity	Total
Community Services	Number	-	-	-	-	-	-	-	-
Non Residential Property		-	-	-	-	-	-	-	-
Residential Property		-	-	1	1	-	-	1	1
Septic Water Tanks		-	-	-	-	-	-	-	-
Utilities		-	-	-	-	-	-	-	-
Rail	Length (km)	-	-	-	-	-	-	-	-
Roads (SEPA)		-	-	-	-	-	-	0.0	0.0
Roads (OS)		-	0.0	0.2	0.3	0.0	0.0	0.2	0.3
Clean Water Network		-	-	0.1	0.1	-	-	0.2	0.2
Total Anticipated Erosion	Area (hectares)	1.0	1.0	8.6	10.6	2.0	1.2	9.7	12.9
Runways		-	-	-	-	-	-	-	-
Cultural Heritage		-	-	-	-	-	-	-	-
Environment		-	0.0	0.0	0.0	-	0.0	0.0	0.0
Flooding (200 year envelope)		0.9	0.4	1.7	2.9	0.9	0.3	1.7	2.9
Flooding (1000 year envelope)		0.9	0.4	1.8	3.1	1.0	0.3	1.8	3.1
Erosion within PVAs		0.1	0.2	2.1	2.4	0.2	0.2	2.4	2.8
Erosion outwith of PVAs		0.9	0.8	6.4	8.2	1.9	1.0	7.2	10.1
Battlefields		-	-	-	-	-	-	-	-
Gardens and Designed Landscapes		-	-	-	-	-	-	-	-
Properties in Care		-	-	-	-	-	-	-	-
Scheduled Monuments		-	-	-	-	-	-	-	-
Nature Conservation Marine Protected Areas		-	-	-	-	-	-	-	-
National Nature Reserves (NNR)		-	-	-	-	-	-	-	-
Special Areas of Conservation (SAC)		0.1	0.1	0.2	0.4	0.1	0.1	0.3	0.4
Special Protection Areas (SPAs)		-	-	-	-	-	-	-	-
Sites of Special Scientific Interest (SSSI)		-	-	-	-	-	-	-	-

References

Ramsay, D.L. and Brampton, A.H. (2000) Coastal Cells in Scotland: Cell 11 - Shetland. Scottish Natural Heritage Research, Survey and Monitoring, Report No 152.

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