

**ST BEES HEAD TO HARRINGTON****Baseline Information**

<b>Start co-ordinate:</b>	295740, 511780	<b>Finish co-ordinate:</b>	298400, 523980
<b>Total length:</b>	15.4km	<b>Defended length:</b>	6.1km
<b>Railway Defences:</b>	5.1km	<b>Rock Armour:</b>	0.4km
<b>Gabions:</b>	0.1km	<b>Harbour Walls:</b>	0.5km
<b>Cliff:</b>	8.8km	<b>Made Ground:</b>	0.6km

**Environmental designations:**

- SSSI (St Bees)

**Monitoring carried out:**

- 24 beach profiles
- Topographic survey (Whitehaven South Beach, Whitehaven North Beach)
- Coastal defence inspection
  - Arrowthwaite (Saltom Pit)
  - Whitehaven South Beach
  - Whitehaven North Beach
  - Parton to Redness Point

**Site overview:**

This northerly section of the Copeland frontage covers the frontage north of St Bees Head to the borough boundary just south of Harrington. This section of shoreline is heavily modified by its industrial past with mines, port/harbour development at Whitehaven and continuation of the Cumbrian coast railway influencing past and present shoreline evolution.

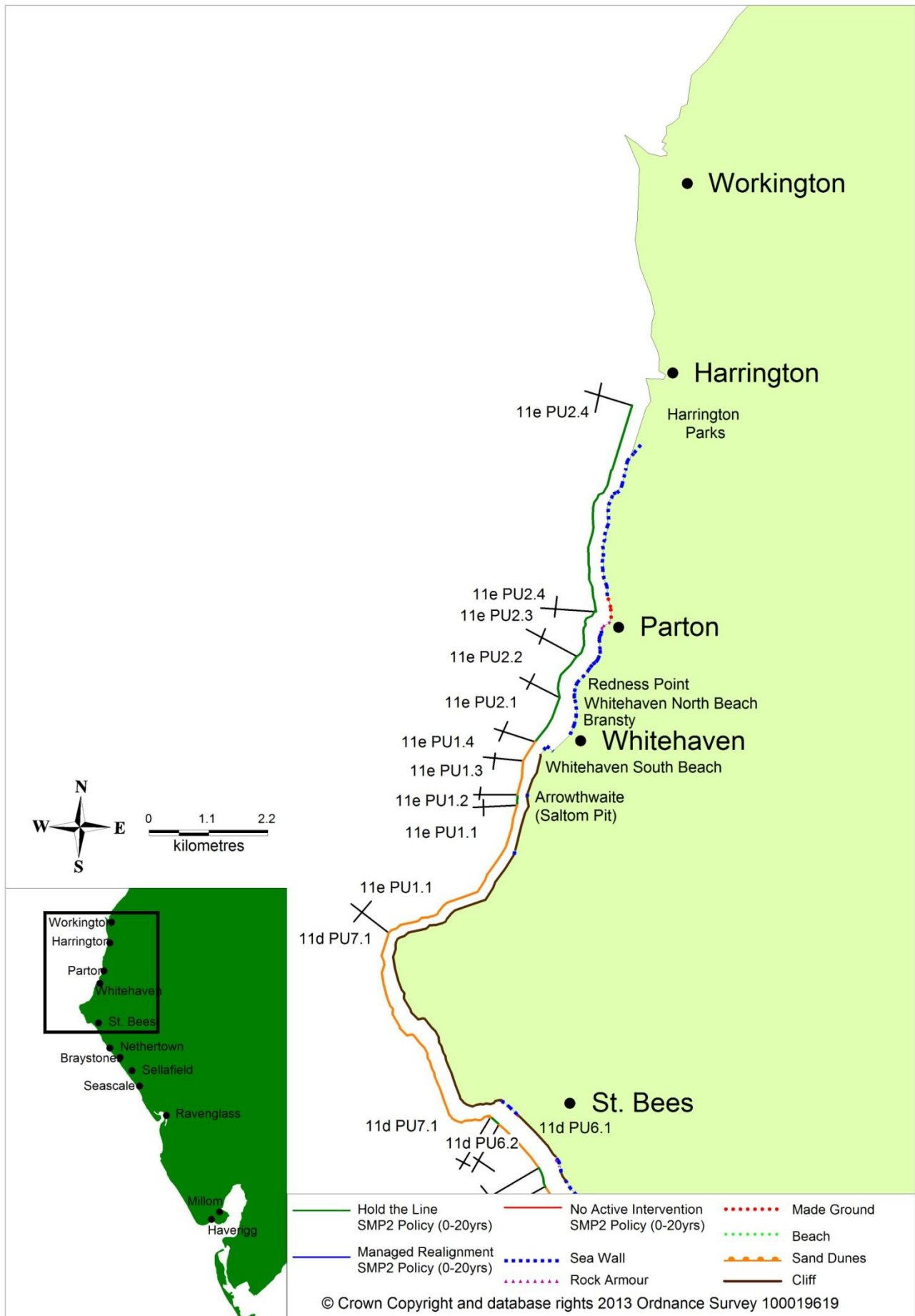
The primary features along this section are the rock headland of St Bees, the harbour at Whitehaven and the extensive engineering defences to the railway across the whole of the frontage north of Whitehaven.

Between St Bees Head and Whitehaven harbour the shoreline is generally a continuation of the rock cliffs of St Bees head overlain with a few areas of exposed clay. The foreshore consists almost entirely of coarse boulders and cobbles interspersed with exposed areas of rock platform and the occasional small patch of sand. North of Whitehaven the foreshore conditions are similar to those south of the harbour with exposed sediments largely comprising boulders, cobbles and shingle interspersed with outcropping rock platform, apart from in Parton Bay where there is a local sand embayment.

**The Current (SMP2) Policy:**

- **St Bees Head:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **St Bees Head to Saltom Pit:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **Saltom Pit:** Hold the Line in the short term (0-20yrs) and medium term (20-50yrs) and Managed Re-Alignment in long term (50-100yrs);
- **Saltom Pit to Whitehaven South Beach:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **Whitehaven South Beach:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs) but carry out works to maintain Whitehaven West (South) Pier, as necessary;
- **Whitehaven Harbour and North Beach:** Hold the Line in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **Bransty to Parton:** Hold the Line in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **Parton:** Hold the Line in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs); and **Parton to Harrington Parks:** Hold the Line in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs).

The plan below summaries the above information graphically:



**Summary of behaviour**

At the southern end of this section the rock headland and platform at St Bees, 3.5km wide, protruding up to 2km seaward of the shoreline to either side and with an elevation of up to 100 metres above sea level, provides a barrier to northwards sediment drift and shelter to the shoreline to the north from the predominant waves.

North of St Bees Head the shoreline is generally orientated closer to NNE/SSW. Consequently beach deposits are more susceptible to movement from waves generally approaching the shoreline more obliquely. Between St Bees Head and Whitehaven harbour the shelter provided by St Bees Head generally limits the waves impacting the shoreline and consequently change is slow and of low magnitude. On the south side of the harbour local turbulence arises from the interface of the west (south) pier with the shoreline, which has been artificially reinforced with mine waste, contributing to on-going erosion of the waste.

At Whitehaven the west (south) pier provides a partial barrier to sediment transport with there being limited movement of sediment across the mouth of the harbour. On the north side of the harbour the pier provides shelter to the shoreline from the predominant waves and change is also slow and of low magnitude.

To the north of Redness Point, the shoreline moves out of the shelter of St Bees Head and the harbour piers. The natural cliffs have been cut off from any direct interface with the foreshore by the extensive railway defences and any sediment drift is almost entirely in a northerly direction.

The following key points arise from analysis of the contemporary monitoring data:

**Offshore Wave Climate:**

Historic wave data from the Met Office & CEFAS identifies:

- Approximately 70% of waves < 1 metres high; Approximately 1.5% of waves > 3 metre high.

**Wind Climate:**

Historic wind data from the Met Office identifies:

- 40-45% of wind greater than 9 metres per second (Force 5 and above) & 45% of wind coming from offshore directions (SW to N).

**Sea Levels:**

- Maximum tide level recorded at Workington in the last 20 years = +5.76 (m ODN) in February 1997, which equates to approximately a 1 in 50 return period; and
- The following predicted extreme tide levels apply (m ODN):

Return Period (years)	Whitehaven	Workington
10	5.36	5.49
100	5.69	5.84
1000	6.02	6.18

**Foreshore & Shoreline Changes:**

St Bees Head:

- No data to determine change

Saltom Bay (St Bees Head to Whitehaven Harbour):

- Trend of beach loss from Whitehaven South Beach and associated erosion of cliff edge (mine waste);
- Average volume decrease of -2,600m<sup>3</sup> per year equivalent to a decrease in beach height of 197mm across the area monitored, based on 2009-2013 data; and
- Profile change: 33% – accretion, 67% – erosion, 0% – no change.

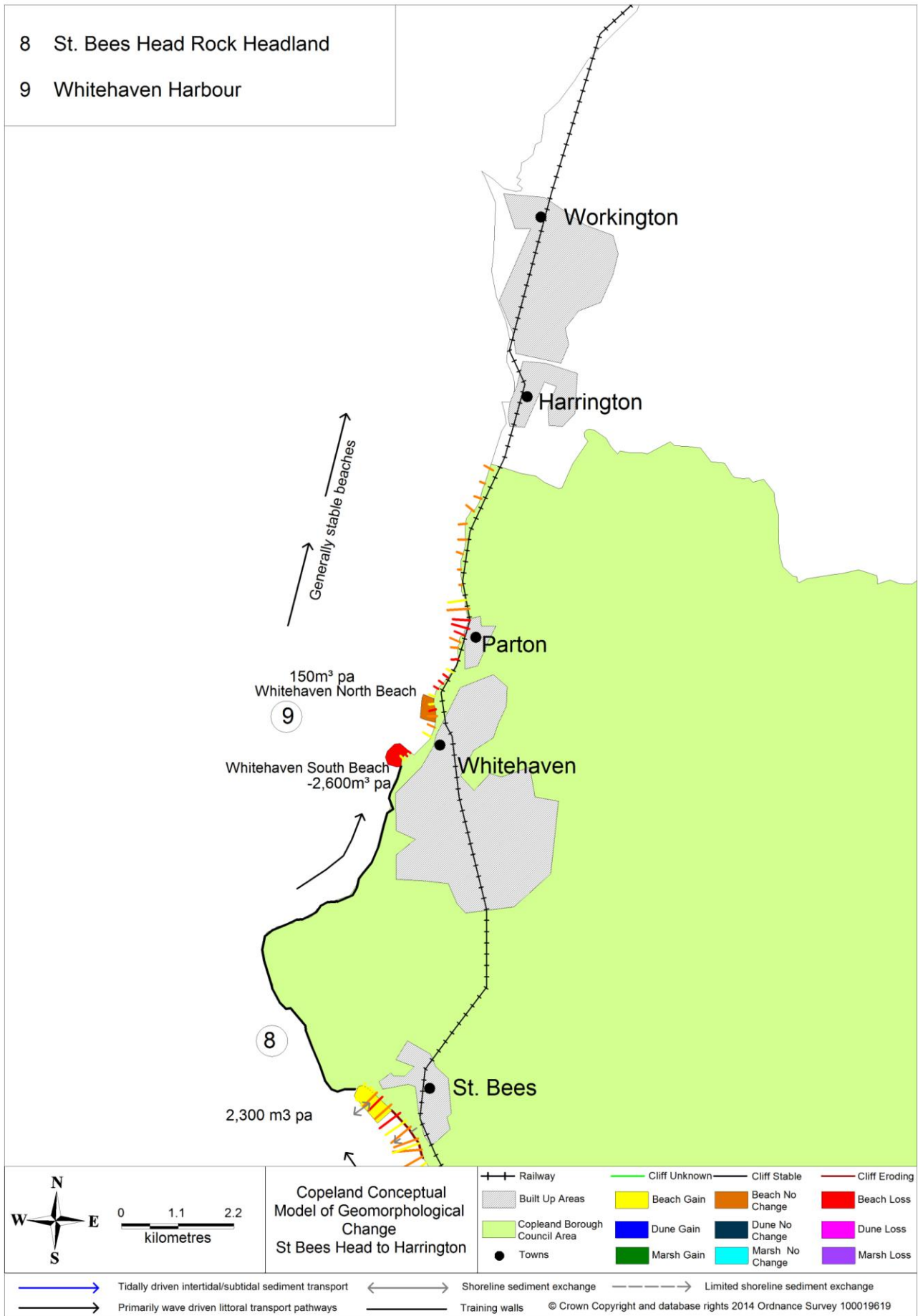
Whitehaven North Beach (Whitehaven Harbour to Redness Point):

- Low magnitude change; average volume increase of 150m<sup>3</sup> per year equivalent to a increase in beach height of 3mm across the area monitored, based on 2009-2013 data; and
- Profile change: 40% – accretion, 20% – erosion, 40% – no change.

Redness Point to Copperas Hill (Boundary with Allerdale):

- Cyclical beach movement but little change in beach profiles, north of Redness Point; and
- Profile change: 23% – accretion, 54% – erosion, 23% – no change.

This behaviour is illustrated graphically on the plan below.



**Risk Assessment**

The primary risks arising from the behaviour of coastal forcing processes (wind, waves and tides) and the reaction of the shoreline (beach and cliff changes, artificial defence conditions) across this frontage are:

- Overtopping of artificial defences at Whitehaven North Beach causing flooding of the hinterland;
- Breaching of artificial coastal defences, causing erosion of the shoreline at Parton;
- Erosion of mine waste shoreline at Whitehaven South Beach with loss of local infrastructure and potential threat to integrity of harbour piers;
- Damage to defences causing disruption to railway operation; and
- Erosion/slippage of cliffs – causing damage to railway and/or loss of land.

The primary consequences of this behaviour are:

- Damage to and/or loss of infrastructure, property and land.

The table below shows the overall risk rating(s) that apply within this section of frontage. Overall risk is defined from the probability of conditions/behaviour occurring and the consequences the conditions/behaviour would have.

<b>Duddon Estuary to Tarn Point Overall Risk Rating</b>				
<b>SMP Policy Unit (11d)</b>	<b>Section of Frontage</b>	<b>Probability Index</b>	<b>Consequence Index</b>	<b>Overall Risk Rating</b>
7.1	St Bees Head	Low	None	Low
<b>SMP Policy Unit (11e)</b>	<b>Section of Frontage</b>	<b>Probability Index</b>	<b>Consequence Index</b>	<b>Overall Risk Rating</b>
1.1	St Bees Head to Saltom Pit	Low	Low	Low
1.2	Saltom Pit	Medium	Medium/High	Medium
1.3	Saltom Pit to Whitehaven South Beach	Low	Low	Low
1.4	Whitehaven South Beach	Medium	Medium	Medium
2.1	Whitehaven Harbour & North Beach	Medium	Medium/High	Medium
2.2	Bransty to Parton	Medium	Medium/High	Medium
2.3	Parton	Medium	Medium/High	Medium
2.4	Parton to Harrington Parks	Medium	Medium/High	Medium

**Current Behaviour**

Analysis of the monitoring data collected in 2013 provides the following key points:

**Offshore Wave Climate:**

- No new data available for analysis.

**Wind Climate:**

- No new data available for analysis.

**Sea Levels:**

- Maximum tide level recorded on Workington tide gauge = +4.808 (m ODN) on 25<sup>th</sup> July 2013, equivalent to a level that would be expected to be exceeded at least once per year.

**Beach Changes:**

Saltom Bay (St Bees Head to Whitehaven Harbour):

- Continued erosion observed in profile data;
- Significant erosion of artificial cliff at Whitehaven South beach, particularly associated with storms in December 2013;
- No data to determine beach volume change; and
- Profile change: 0% – accretion, 67% – erosion, 33% – no change

Whitehaven North Beach:

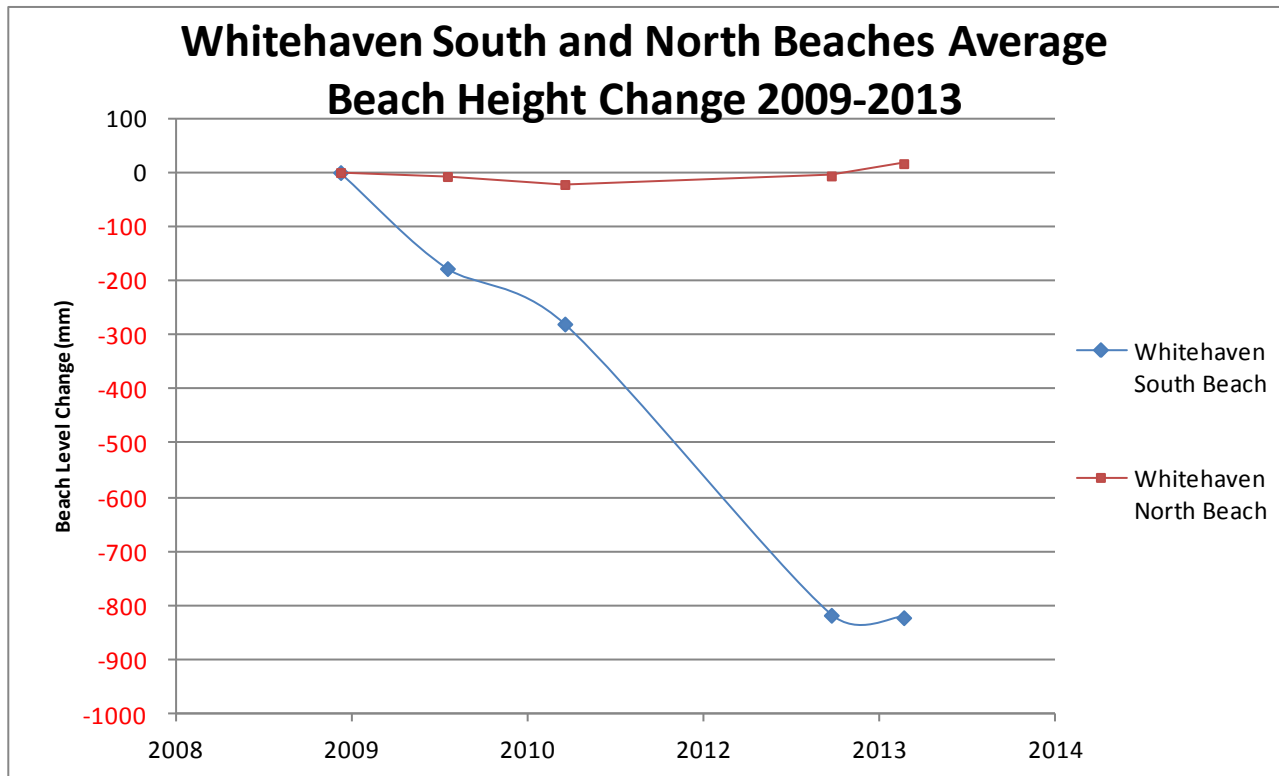
- Slight increase in beach cross sectional areas and little change associated with December 2013 storms;
- No data to determine beach volume change; and

- Profile change: 40% – accretion, 0% – erosion, 60% – no change.

Redness Point to Harrington:

- Reduction in beach cross sectional areas at southern end but elsewhere little change. Little change associated with December 2013 storms
- No change in condition of defences (Parton to Redness Point)
- Profile change: 31% – accretion, 31% – erosion, 38% – no change

The plot below shows the change in the average height of the beach across the Whitehaven frontage from 2009 to 2013.



### **Uncertainties & Issues**

The following uncertainties have arisen from the data monitoring programme and analysis of the data collected:

- Quantities of sediment arriving on the beach from offshore.
- Beach change over complete foreshore
- Wave conditions occurring directly in front of shore currently unknown.
- Cliff erosion Rates between St Bees and Whitehaven
- Magnitude of sediment by-passing Whitehaven Harbour.

### **Future Management Actions**

The following monitoring and management actions are recommended:

- Continue current monitoring regime
- Improve additional remote sensing e.g. LiDAR,
- On-going monitoring of condition of artificial defence structures
- Carry out remedial works to maintain integrity of defences, as required.

### **Linkage(s) to Decision Making**

The monitoring provides information to support:

- Implementation of SMP2 policies, particularly; identification of timing for future capital works or capital maintenance works for artificial defences;
- Continued maintenance and operation of railway
- Decision making process in relation to development planning control.

The plot below summarises the results from the monitoring data analysis for this section in 2013.

