

SEASCALE TO ST BEES HEAD**Baseline Information**

Start co-ordinate:	304550, 498800	Finish co-ordinate:	295740, 511780
Total length:	16.1km	Defended length:	3.8km
Railway Defences:	2.0km	Rock Armour:	0.1km
Gabions:	0.1km	Sea Wall:	1.6km
Beach:	3.6km	Sand Dunes:	4.8km
Clay Cliff:	3.8km	Other:	0.0km

Environmental designations:

- SSSI (St Bees)

Monitoring carried out:

- 61 beach profiles
- Topographic survey (Seascale, Braystones to Nethertown & St Bees)
- Coastal defence inspection
 - Seascale
 - Sellafield
 - Braystones to St Bees

Site overview:

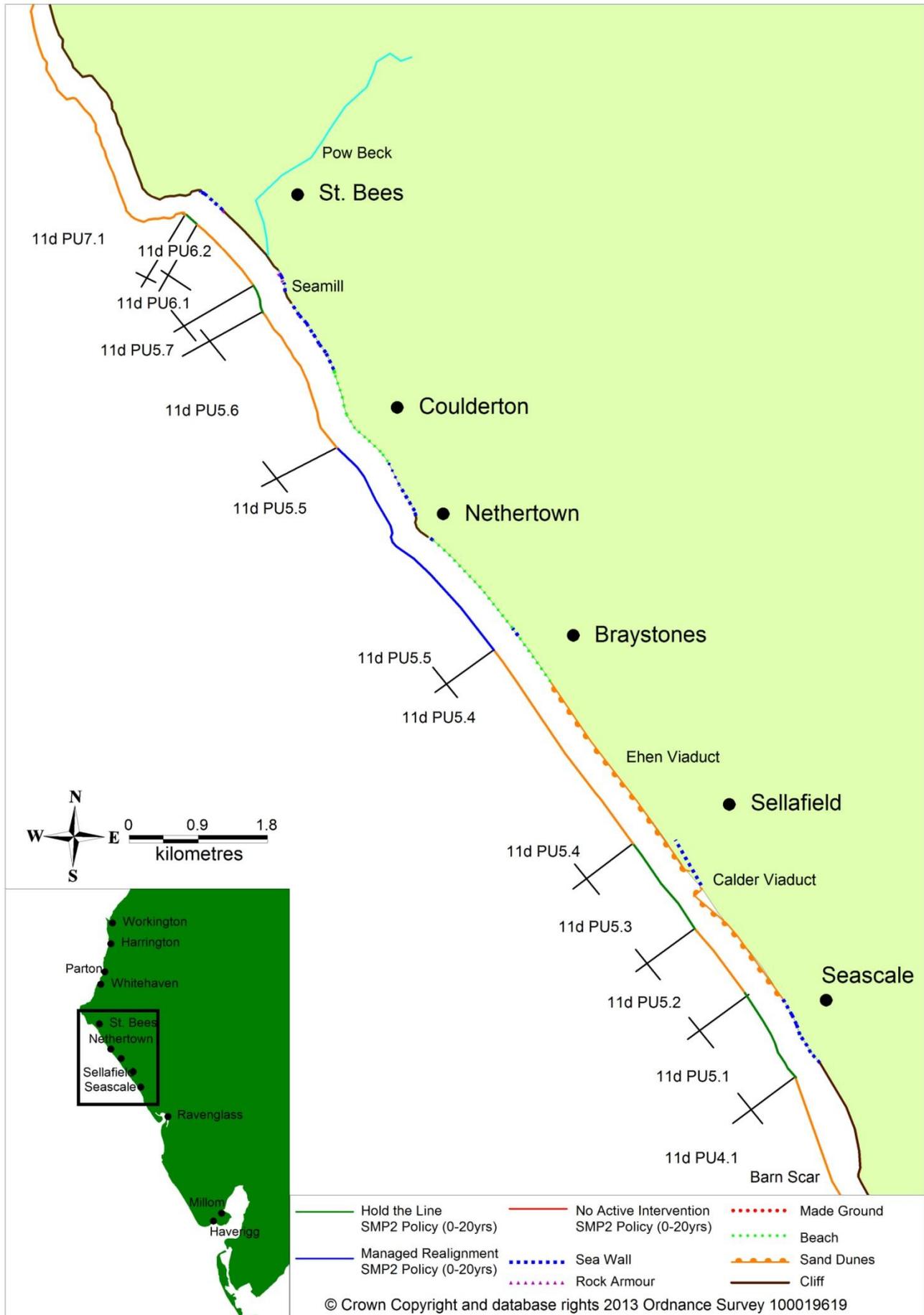
This section of frontage has been heavily modified by engineering works. Shoreline evolution has been significantly affected over the past 150 years as a result of the construction of the coast railway along the majority of this length, apart from at the extreme north and south ends. There are a number of local settlements e.g. Seascale, Nethertown and St Bees located adjacent to the shoreline together with local developments on the beach at Braystones, Nethertown and Couderton, which date originally from the 1920s. In addition the nuclear power station and now processing facility at Sellafield (formerly Windscale), has been in existence since the mid 1950s.

The natural backshore comprises generally till cliffs but apart from localised sections, between Seascale and Drigg, at Nethertown and at St Bees, the cliffs no longer directly abut the foreshore due to the construction of the railway line. The beaches consist of an upper shingle beach and lower sand beach, although across much of the shoreline the lower beach is interrupted by skears comprising coarser boulders and cobbles, remnants of past cliff erosion. Occasionally sandstone bedrock outcrops on the upper beach e.g. at Nethertown. Coastal defences are primarily associated with providing protection to the railway apart from localised defences at Seascale, Nethertown, Seamill and St Bees.

The Current (SMP2) Policy:

- **Drigg Point to Seascale:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **Seascale:** Hold the Line in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **Seascale to Sellafield:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs), except where works are necessary to maintain railway operation;
- **Sellafield:** Hold the Line in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **Sellafield to Braystones:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs), except where works are necessary to maintain railway operation;
- **Braystones, Nethertown and Couderton:** Managed Realignment in the short term (0-20yrs), No Active Intervention in the medium term (20-50yrs) and long term (50-100yrs), except where works are necessary to maintain railway operation;
- **Couderton to Seamill:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs), except where works are necessary to maintain railway operation;
- **Seamill to Pow Beck:** Hold the Line in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **Pow Beck to St Bees Promenade:** No Active Intervention in the short term (0-20yrs), medium term (20-50yrs) and long term (50-100yrs);
- **St Bees Promenade:** Hold the Line in the short term (0-20yrs) and medium term (20-50yrs) and Managed Realignment in long term (50-100yrs); and
- **St Bees Head:** No Active Intervention 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

The frontage is almost entirely orientated facing the predominant south westerly wind and wave direction. Accordingly longshore drift is weak and variable with net movement of the beach occurring northerly across the majority of the frontage. The exceptions to this are local reversals in the direction of sediment movement. This occurs at the southern end between Barn Scar and the Ravenglass estuaries and across the Sellafeld frontage between the outlets of the river Ehen and Calder. At these locations material is mostly moved in a southerly direction. Material is also moved towards the shoreline from offshore by wave action.

Current behaviour is artificially influenced by defences to the railway, the location of properties on the foreshore, between Braystones and Nethertown and at Couderton, and heavily engineered defences at St Bees (Sea wall and groyne). At the northern end of the frontage further movement of sediment is prevented by the rock headland and platform at St Bees, some 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.

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) & 70% of wind coming from offshore directions (NW to SE)

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.
- The following predicted extreme tide levels apply (m ODN):

Return Period (years)	Workington	Seascale	St Bees
10	5.49	5.53	5.34
100	5.84	5.87	5.67
1000	6.18	6.18	5.99

Foreshore & Shoreline Changes:

Seascale:

- Localised trend of increase in beach levels across Seascale frontage
- Cyclical beach movement but stability to north and south of Seascale
- Average volume increase of +3,700m³ per year equivalent to an increase in beach height of 14mm across the area monitored, based on 2009-2013 data
- Profile change: 42% – accretion, 8% – erosion, 50% – no change

Sellafeld:

- Profile change: 100% – accretion, 0% – erosion, 0% – no change (based on one profile only)

Ehen Viaduct to Nethertown

- Overall reduction in beach volume within cyclical trend
- Average volume decrease of -6,300m³ per year equivalent to a decrease in beach height of 10mm across the area monitored, based on 2004-2013 data. Alternative reversed shorter term trend of +13,600m³ per annum for 2009-2013 equivalent to a increase in beach height of 22mm across the area monitored.
- Profile change: 36% – accretion, 23% – erosion, 41% – no change

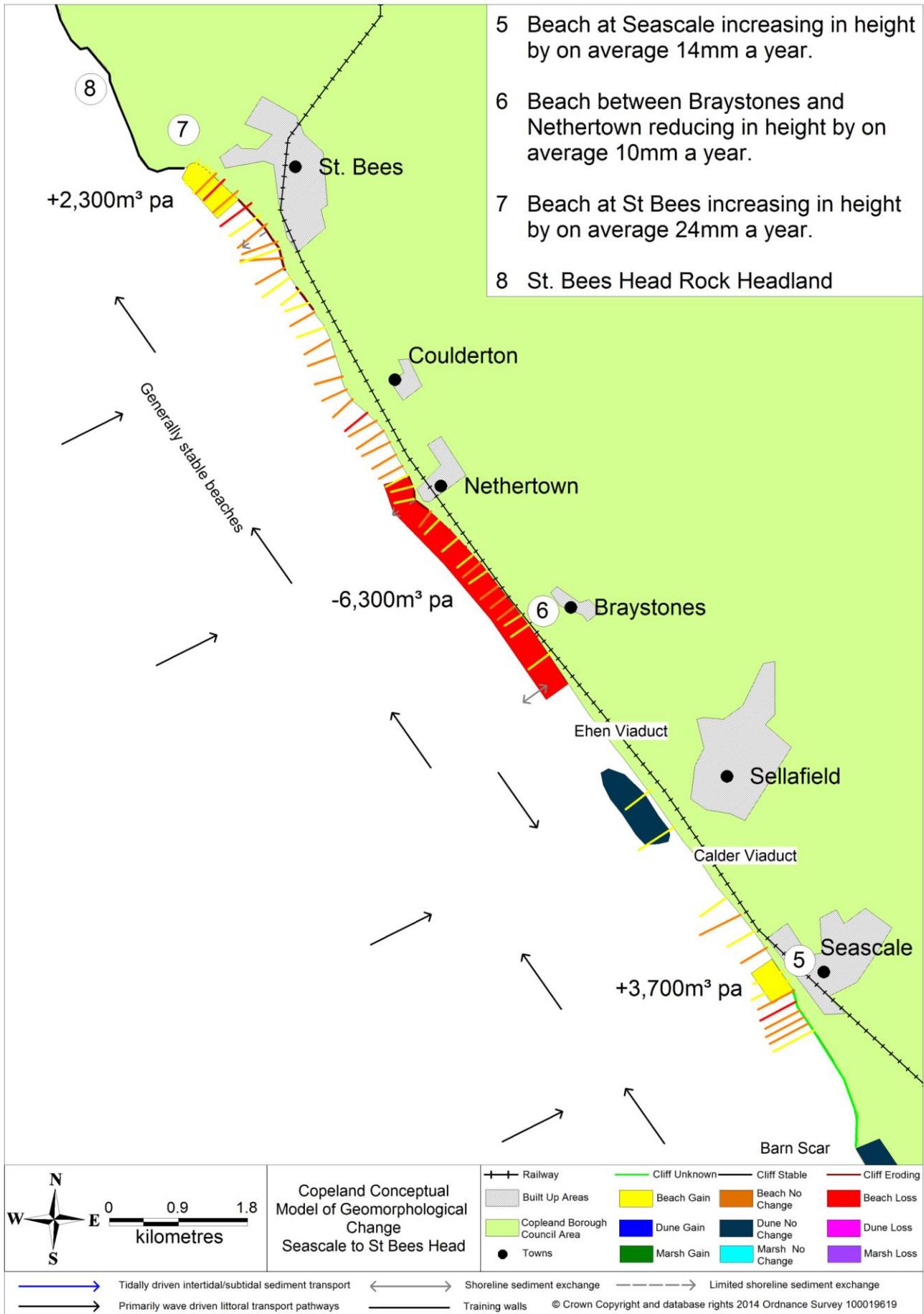
Nethertown to Seamill

- Beach movement across lower sand beach but little overall change
- Profile change: 37% – accretion, 5% – erosion, 58% – no change

Seamill to St Bees

- Modest cliff erosion
- Beach stability at St Bees prior to 2013
- Average volume increase across St Bees frontage of +2,300m³ per year equivalent to an increase in beach height of 24mm across the area monitored, based on 2009-2013 data.
- Profile change: 47% – accretion, 13% – erosion, 40% – 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 causing flooding of the hinterland,
- Breaching of artificial coastal defences, causing erosion of the shoreline
- Overtopping of beach causing flooding and damage (loss) of beach properties
- Damage to defences causing disruption to railway operation
- Erosion/slippage of cliffs – causing damage to railway and/or properties

The primary consequences of this behaviour are:

- Damage to and/or loss of property and infrastructure
- Damage to environmental habitats.

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.

Duddon Estuary to Tarn Point Overall Risk Rating				
SMP Policy Unit (11d)	Section of Frontage	Probability Index	Consequence Index	Overall Risk Rating
4.1	Drigg Point to Seascale	Medium	Medium/High	Medium
5.1	Seascale	Medium	High	Medium
5.2	Seascale to Sellafield	Medium	Medium/High	Medium
5.3	Sellafield	Medium	Medium/High	Medium
5.4	Sellafield to Braystones	Medium	Medium/High	Medium
5.5	Braystones, Nethertown and Couderton	Medium	High	High
5.6	Couderton to Seamill	Medium	Medium/High	Medium
5.7	Seamill to Pow Beck	Low	High	Medium
6.1	Pow Beck to St Bees Promenade	Medium	Medium	Medium
6.2	St Bees Promenade	Medium	Medium	Medium
7.1	St Bees Head	Low	None	Low

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 25th July 2013, equivalent to a level that would be expected to be exceeded at least once per year.

Beach Changes:

Seascale:

- Beach volumes decreased by -5,000m³. Equivalent to an average decrease of approximately 19mm across the area of beach monitored.
- Cyclic behaviour.
- Profile change: 17% – accretion, 8% – erosion, 75% – no change

Sellafield:

- Profile change: 100% – accretion, 0% – erosion, 0% – no change (based on two profiles)

Ehen Viaduct to Nethertown

- Beach volumes decreased by 18,000m³. Equivalent to an average decrease of approximately 29mm across the area of beach monitored.
- Variable change, some areas accreting others eroding.
- Profile change: 33% – accretion, 22% – erosion, 44% – no change

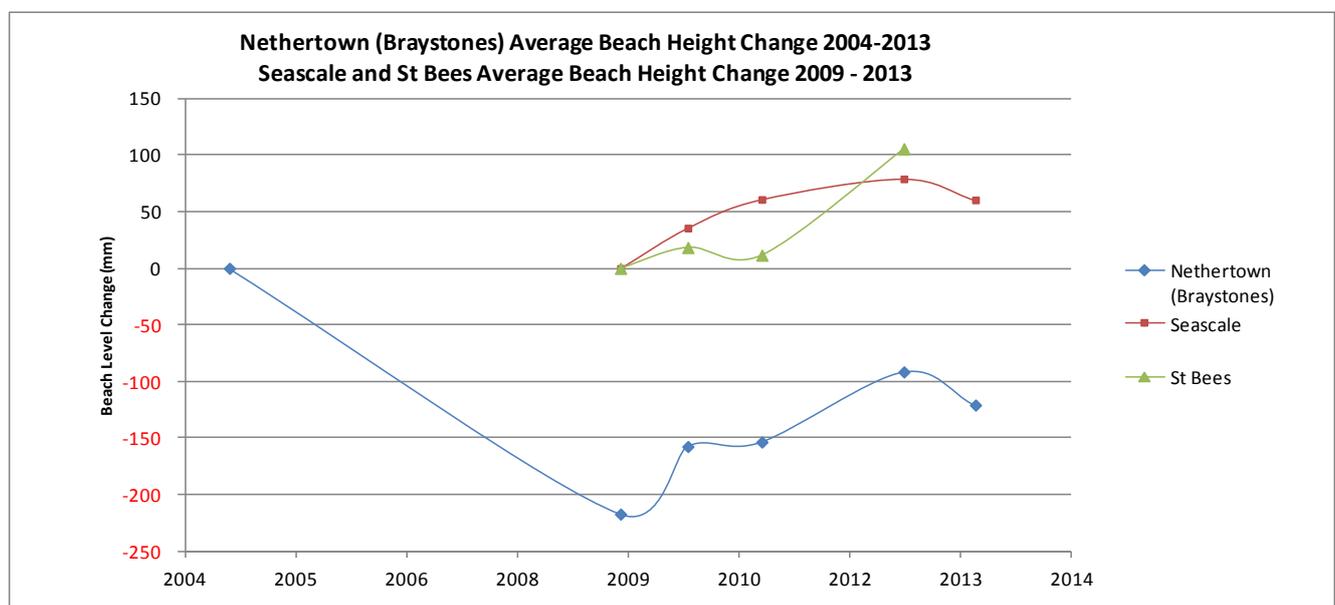
Nethertown to Seamill

- Profile change: 29% – accretion, 12% – erosion, 59% – no change

Seamill to St Bees

- Beach volumes at St Bees increased by 9,000m³. Equivalent to an average increase of approximately 94mm across the area of beach monitored.
- Cyclic behaviour, with little overall change.
- Profile change: 47% – accretion, 27% – erosion, 27% – no change

The plot below shows the change in the average height of the beach across the Braystones to Nethertown frontage from 2004 to 2013 and the Seascale and St Bees frontages 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

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

