Coastal Morphology Report

Thorpeness (Phase 1)

RP024/S/2011

July 2011

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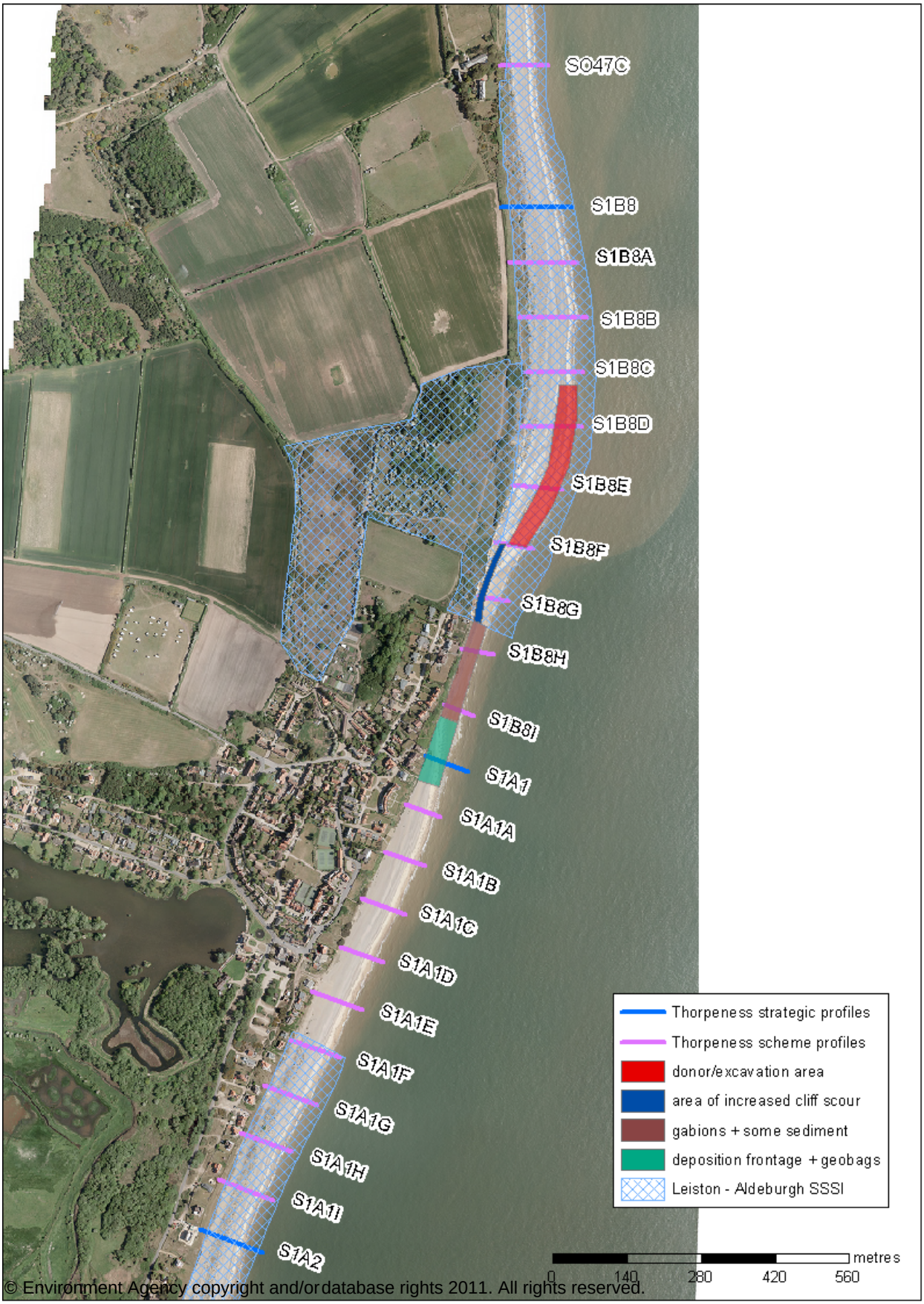
Erosion protection at Thorpeness (Photo: Environment Agency)

Glossary

Accretion	The accumulation of sediment on a beach by the action of natural forces or as a result of artificial structures
Beach recharge/recycling	Artificial process of replenishing a beach with material from another source or from an adjacent frontage
Berm crest	Ridge of sand or gravel deposited by wave action on the shore just above the normal high water mark
Erosion	The loss of material from a beach by the action of natural forces or the result of man-made artificial structures interfering with coastal processes
Foreshore	The area of beach lying between high water and low water
Foreshore rotation	Foreshore steepening or flattening resulting in the convergence or divergence of high and low water marks
Gabion	Rock filled wire basket
Groyne	Shore protection structure built perpendicular to the shore; designed to trap sediment
Longshore drift	Movement of sediment along the shoreline
MHWS	level of Mean High Water Spring tides
MLWS	level of Mean Low Water Spring tides
MSL	Mean Sea Level
Ness	A large low-lying foreland or promontory of mobile sands or shingles attached to the foreshore
Soft defences	Engineering options which are non-rigid (like sea walls) and which work with the natural coastal processes of wave action and sediment movement



Map 1 - Thorpeness study area

1.0 Aim of report

The aim of this report is to discuss the beach morphology at Thorpeness and the Ness paying particular attention to erosion areas following the June 2010 storm event. It also aimed to ascertain if recycling works, ie extraction from the donor area at the Ness has had any detrimental effect on the SSSI or on adjacent lengths of the shore.

This Phase I report focuses on data up to and including June 2011 and therefore contains no reference to data gathered since then. It is the intention to issue a Phase II monitoring report upon completion of that phase of monitoring.

1.1 Description and history

The Thorpeness frontage is predominantly backed by cliffs of sandy glacial till and fronted by a wide shingle beach. The shingle beach has a number of ridged features and an active shoreface system The Ness, between Thorpeness village and Sizewell is an accumulated sediment feature formed on an outcrop of Red Crag with the backshore containing areas of established vegetated shingle.

The coast generally remains stable along this frontage with a mean trend of around +/- 0.1 m/yr, (Suffolk Coastal Trends Analysis, 2011) but will typically go through erosive phases around once every 30 years (Haskoning, Oct 2010). There is a net southerly drift of sediment and a potential for net offshore transport of fines under erosive conditions.

The Ness at Thorpeness is part of the Leiston to Aldeburgh Site of Special Scientific Interest (SSSI), with the backshore containing valuable vegetated shingle habitat with different types of species dependent upon the structure of the shingle for its survival, such as sea kale, yellow horned poppy and sea spurge. It is an important habitat for breeding birds and invertebrates. Seawards of this is an area of more mobile shingle and transitory berm features.

Figure 1 – Thorpeness Ness, looking northwards (June 2011)

This frontage is prone to rapid episodic erosion events associated with the removal and/or redistribution of beach material further down the beach profile or offshore. The resulting exposed toe of sea defences and eroded cliffs leaves the beach unable to dissipate wave energy from further storm events thus leading to further scour.

Untypical weather conditions during early 2010 removed significant volumes of sediment from the frontage below North End Avenue to reveal gabion baskets (put in place in the 1970s to protect the coast following a previous erosional event), and erosion to the already eroding unprotected cliff face just to the north of this. Outflanking occurred either side of the gabion structure. It appeared that the erosion coincided with accretion at the Ness supporting a theory of local redistribution as opposed to loss to the system.

Community funded emergency beach protection works began in October 2010 to help protect a number of properties along the cliff top in North End Avenue. Works consisted of the placement of sand/shingle filled geotextile bags (geobags) to form a new soft defence to protect a vulnerable cliff face immediately south of the existing gabion defence. Bag filling and laying operations were completed in December 2010 with the shingle recycled from the Ness to cover the bags completed in February 2011. Small volumes of material were removed from the Ness in November and December however the significant recycling operation was done between 8 – 11 February 2011. A table of quantities and dates is shown in Appendix C on page 41.

Phase I emergency protection works at Thorpeness were completed in February 2011 and this Phase I report looks at data up to and including the June 2011 survey. The next Phase of works (Phase 2) are expected to run from August to November 2011 and will be funded by the Environment Agency, Suffolk Coastal DC and the local community. Works will involve strengthening the existing gabion structure using a combination of sand filled geobags and rock infill and ongoing maintenance works are expected following completion.

Marine Licences (previously FEPA licences) were required for both Phase 1 and 2 of the works as a result of consultation with the Marine Management Organisation (MMO) with beach surveys undertaken monthly in targeted locations to monitor beach health. Monitoring for Phase I has now finished with Phase 2 monitoring beginning in September 2011.

The monitoring at Thorpeness by Environment Agency and Waveney District Council (on behalf of Suffolk Coastal District Council) is part of the Anglian Region Coastal Monitoring Programme. Strategic profiles (three in total) date back to 1991 with more recently, closely spaced scheme profiles, surveyed from 2009. Surveyed beach profiles are undertaken by the Shoreline Management Group's (SMG) surveying contractor, EDI. A table of survey dates for each profile is shown in Appendix A on page 17, with the extent of the area under analysis shown in Map 1 on page 1.

Analysis has been undertaken in the SMG's bespoke beach analysis software, Beach Profile Inspection Tool (BPIT), together with aerial analysis from 1992. Analysis looked at the history of each profile along with pre and post-excavation surveys in particular to see if any adverse effects resulted in the donor area and adjacent profiles. In addition, analysis looked at morphology along the deposition frontage and whether newly reshaped profiles maintained form in the months immediately after works completed.

The scour experienced at the northern end of the village is also associated with an accumulation of sediment at the southern end of the Ness with distinct shoreline berms or ridges building seawards under constructive wave/ beach building conditions. It is this newly deposited shingle which does not support any vegetation which formed the basis for the donor sediment supplied to the gabioned and geo-bagged areas to the south.

2.0 Analysis of beach profiles

SO47C – Ness House, surveyed since 2010W

There is no movement in the dune cliff face, which is well established with vegetation. In front of this there is a stable vegetated shingle upper beach leading to the toe of the cliffs. At MHWSs beach levels fluctuate naturally by around one metre down to low water. This active beach face showed the highest foreshore berm in October 2010 (2010J). There are no obvious signs of the storm event at this profile location (see Appendix B1).

Figure 2 – Vegetated shingle backshore at Thorpeness Ness with Ness House (left) and Sizewell power station (right) in background (June 2011)

S1B8 – northern end of Ness, surveyed since 1991S

A generally stable beach profile. The recent Suffolk Coastal Trends report (2011) shows this profile to have minimal movement between high and low water – an erosional trend of 0.1 m/yr. The upper beach and cliff face have also shown no movement. There is seasonal movement in the intertidal area and movement of the high water ridge features (berms) along the shoreface. The highest seawards berm is higher than the land landwards of this, creating a trough-shaped beach. There appears to be some lower beach accretion from January to June 2011 (see Appendix B2).

S1B8_A – northern end of Ness, surveyed since 2009W

The beach is trough-shaped and backed by sand vegetated cliffs and fronted by the highest foreshore berm. The seaward face of the highest foreshore berm retreated landwards by 3 – 4 metres between 2009W to 2010W but was partially rebuilt by the time of the 2011W survey (see Appendix B3).

S1B8_B – northern end of Ness, surveyed since 2009W

This is a stable trough-shaped beach backed by dune cliffs. The foreshore berm stands at 60m chainage in July 2010 and has moved landwards by 5m in October 2010 survey following which this part of the beach begins to flatten. There is development of a distinct bar feature just above high water between January to July 2010, which may have been as a result of the storm event in May/June. (see Appendix B4).

S1B8_C – northern end of Ness, surveyed since 2009W

A less trough-shaped beach compared to further north, with the Ness ridge lying more centrally in the upper beach where there is no movement. There was seaward accretion in the beach face intertidal area between January 2009 to July 2010. Then following this survey to 2011W the intertidal area retreated landwards by 10 metres. (see Appendix B5).

S1B8_D – apex of Ness, excavation area, surveyed since 2009W

The ness ridge lies centrally within the upper beach, which appears very stable. The lower beach intertidal area builds seawards from 2009W to 2010S to create a seaward berm which retreats 5 metres by October 2010 and flattening to December 2010.

There is evidence of sediment removal between January and February 2011 at the face of the MHWS berm but this shows no effect on any other part of the beach. By May 2011 a new high water berm is evident moving onshore and is associated with increases in volume in the intertidal area and which retreats slightly by June 2011 (see Appendix B6).

S1B8_E – lower Ness, proposed excavation area, surveyed from 2009W

The sand dune cliffs here are much steeper with the Ness ridge lying at the base of the cliffs. In 2009W, 2009S and 2010W surveys the beach is relatively narrow and steep at 24 – 25 metres. However, by summer 2010 the profile has extended seawards by around 35 metres with a distinct ridge just above MHWS along with beach lowering of around half a metre at the foot of the cliffs. By 2011W the intertidal area has receded by 10 metres along with associated movement of high water ridge. Levels at the toe of the cliff remain lower. There are no February 2011 profiles to see if excavation at donor area has had any effect (see Appendix B7).

S1B8_F – lower Ness, base of proposed excavation zone, surveyed from 2009W

Steep cliffs are fronted by a much narrower beach. The 2010W profile shows a distinct storm profile with beach drawdown and levels 3 metres lower in the intertidal area, a few metres in front of the toe of the cliff. Beach levels have recovered by summer 2010 with a berm at MHWS and lower beach levels behind this (ie in front of the cliffs). There is further beach building by October 2010 where the dip behind the berm has been infilled (see Appendix B8).

From January 2011 the foreshore continues to build to create a trough beach shape with a MHWS berm with no evidence of any sediment loss. By May 2011 sediment is lost from the face of this berm and by the June survey this has partially repaired itself. Levels are higher in February at the MHWS berm than in January, pre-excavation surveys (see Appendix B9).

S1B8_G – area of significant scour just north of gabioned area, surveyed from 2009W

The vertical cliff face here retreats by 4.5 metres between the 2010W and 2010S surveys. According to anecdotal evidence there was increasing erosion pressure during the spring of 2010 which then culminated in the storm event of June 2010, with beach drawdown evidenced along the entire profile. There is a flat foreshore with no ridges or berms and the upper beach at the toe of cliffs is also greatly scoured.

Beach levels recover slightly to October 2010 by half to one metre. A small MHWS berm builds to 2011 April but subsequent surveys showed this to have scoured and moved onshore. There is no obvious reduction in the foreshore between January and February surveys, when beach extraction would have taken place further north – in fact the beach has accreted vertically and seawards at the high water berm (see Appendix B10 and B11).

Figure 3 – Area of increased cliff scour just north of gabioned section, looking southwards (June 2011)

S1B8_H – gabioned section, adj. to No. 22 North End Avenue, surveyed from 2009W

Beach levels drop sharply from 2009S to 2010W by up to 2 metres and then a further 1.5m to 2010S as a result of the June 2010 storm event (therefore beach levels are observed to have dropped sharply even before the storm), and by over 2 metres at the toe of the defence By October 2010 foreshore levels have recovered slightly.

Levels at the toe of defence in the February 2011 survey have risen by 60 cm possibly as result of the small amount of recharge here at the foot of the gabions and associated with the deposition frontage further south. By May 2011 this toe has returned to January levels (see Appendix B12).

S1B8_I – southern end of the gabion defences, adj. 'Cheneys', North End Ave, surveyed from 2009W

Beach levels in front of the gabion defence drop between 2009S to 2010W in the intertidal area and the upper foreshore. By 2010S levels drop sharply at the defence toe by almost 3 metres to show the beach at its lowest level following the June storm. By 2011W beach levels have recovered slightly with a one metre accretion at the toe following limited repairs to the original gabions (see Appendix B13).

Figure 4 – Gabioned section at Thorpeness adjacent to North End Avenue, looking northwards (June 2011)

S1A1 – deposition frontage, adj. 'Stella Maris', North End Ave, surveyed from 1991W

The recent Suffolk Coastal Trends analysis showed this profile as a very dynamic beach with periods of erosion and accretion. There was overall accretion to 2001 followed by a period of erosion to summer 2010 with beach levels returning to landwards of their 1991 position. An overall mean trend of no movement (0.1 m/yr) is recorded. Summer 2010 levels were at their lowest at the toe of shingle backslope defence, following the sustained storm event in May/June 2010. Intertidal water levels subsequently moved onshore by around 20 metres.

The natural rebuilding of the toe at this site can be observed in the October and November 2010 surveys. In December 2010 and January 2011 the bare geobags are observed at the toe of the backslope in a stepped shape. Subsequent surveys from February to June 2011 show deposited sediment from the recycling operation covering this defence and maintaining profile, albeit at lower levels than from 1991S to 2009W (see Appendix B14).

S1A1_A – 'The Headlands', south of deposition area, surveyed from 2009W

The few surveys available show a fairly dynamic beach with a storm profile shown in 2010S following the June storm event, where beach levels have dipped at toe of shingle backslope by one metre in height. This area of scour is also associated with a drop in height of similar depth

in the intertidal zone. In 2011W (January) survey beach levels did not recover – with the area of scour moving further onshore towards the foot of shingle bank (see Appendix B15).

S1A1_B – Drake House, surveyed from 2009W

This profile shows no evidence of the June 2010 storm in its surveys. There is no movement in the berm visible midway across the upper beach. The winter 2011 profile however shows scour at the seaward face of this berm and in the intertidal area (see Appendix B16).

Figure 5 – Thorpeness frontage south of the gabioned section, looking southwards (June 2011)

S1A1_C – Ogilvie Lodge, surveyed from 2009W

At this point the beach returns to a slightly more trough shaped as noted on the Ness. A stable beach only showing sediment movement seawards of the midshore berm (the active beach face). There is evidence of scouring in 2010W but not 2010S as might be expected. Subsequent beach rebuilding from December 2010 builds a new berm seawards of the midshore berm just above MHWS level. Intertidal levels remained fairly constant during the survey period (see Appendix B17).

S1A1_D – Toad Hall, surveyed from 2009W

A stable beach profile with a midshore berm at a height of over 4m AOD. The face of the berm above high water and the intertidal zone show beach building to winter 2011 (see Appendix B18).

S1A1_E – ‘Gunyah’, Remembrance Road, surveyed from 2009W

A broad trough-shape beach fronted by the highest berm of 4m AOD. The beach face is dynamic seawards of highest crest with slight accretion in the intertidal area to 2011W (see Appendix B19).

S1A1_F – ‘Sans Souci’, Remembrance Road, surveyed from 2009W

The beach profile displays a trough shaped backshore fronted by a beach berm at 4.5mAOD. There is a dynamic beach face with overall accretion at intertidal zone during the survey period.

S1A1_G – ‘Chicoutimi’, Thorpe Road, surveyed from 2009W

The beach frontage continues southwards with a trough-shaped backshore fronted by a slightly lower beach berm at 4mAOD. There is a dynamic beach face in front of the highest crest with no rotation in the intertidal area. The most recent survey shows a fairly eroded beach face fronted by a high water berm. (see Appendix B20).

S1A1_H – ‘Corners’, Thorpe Road, surveyed from 2009W
S1A1_I – ‘The Shingles’, Thorpe Road, surveyed from 2009W

As this frontage continues south beach morphology retains its distinctive trough shape with the highest foreshore berm slightly lower at 3.8 mAOD . The foreshore face of this berm has receded by around 10 metres with intertidal area receded by around 5 metres during the survey period with loss in height of the most seaward berm (see Appendix B21 and B22).

S1A2 – ‘Cranleigh’, Thorpe Road, surveyed 1992W to 2011W

The Suffolk Coastal Trends Analysis report (2011) shows S1A2 to have a moderate erosional trend of 0.8 m/yr. There is progressive retreat of the foreshore with no beach steepening in the intertidal area. However the beach face in front of the highest midshore berm does show some steepening. This highest midshore berm with a height of 4 metres has moved landwards by 15m metres during the survey period There is no movement in the backshore. (see Appendix B23).

2.1 Aerial analysis

The series of aerial photos below (Figures 6a and 6b) show an erosional event between 2001 and 2005 in the present scour area. There are exposed gabions as well as scour just to the north of this with a structure (just north of S1B8G) no longer sitting on top of the cliff as in 2001 aerial but now located on the upper beach in front of the dune cliffs. This event has not been picked up by any of the beach profiles as the strategic profiles are much further north and south of here and the nearest profile S1B8G, for example, only being surveyed from 2009.

Between 2009 and 2010 aerials photographs, the June 2010 storm event is very much in evidence with renewed exposure of the gabions adjacent to North End Avenue and further scour in the cliff area, just to the north. The distance of cliff retreat evidenced here can be seen in the S1B8G beach profile in Appendix B10 to be around 4.5m (see Figure 8).

2010 aerials also shows the accumulation of sediment to the south side of the Ness together with foreshore berms at an oblique angle resulting from previous storm events. In previous years the foreshore ridges and berms all appear to run parallel to the beach. The Ness morphology is detailed further in Figure 7 overleaf for the years 1997, 2005, 2008, and 2010, with the erosion events shown in 2005 and 2010 at the southern end of the Ness.

At the time of writing there are no 2011 aerials available for more up-to-date comparisons to be made.

Figure 6a – aerial analysis in the scour area for 2001 and 2005 showing an erosion event in 2005 with exposed gabions and beach scour in the sand cliffs to the north

Figure 6b – aerial analysis in the scour area between 2009 and 2010 showing the June 2010 storm event with further exposed gabions and increased beach scour in the sand cliffs to the north. The Ness has accreted at its southern end with oblique sediment ridges.

Figure 7 – Comparisons in Ness morphology, 1997, 2005, 2008 and 2010. Erosion events are shown in 2005 and 2010 at the southern end of the Ness. Foreshore berms are most apparent in the 2010 aerial.

Figure 8 – Beach frontage at North End Avenue showing major scour between 2009 and 2010 aerials. There is erosion either side of the gabioned area and increased scour north of the gabions. This loss of sediment is associated with increased sediment accumulation at the southern end of the Ness.

3.0 Summary

Beach profiles alongshore at Thorpeness generally show a trough shaped beach profile backed by a dune cliff and fronted with a high foreshore berm, usually with a height in the region of 4mAOD. The exception to this is within the area of the gabioned and scour area at the north end of the village where the beach is much narrower and flatter and with high water springs (MHWS) close to the toe of the defence.

From the centre of the Ness a midshore berm is also in evidence which moves closer inland as it travels south and where it then joins the toe of the cliff just north of the major scour area. The foreshore berm is also depicted alongshore in beach profiles of the Ness moving closer inland as it moves south along the Ness and then disappearing just north of the scour area, (north of the village), where sediment has been stripped from the beach. The foreshore berm then reappears south of the deposition area at S1A1B.

This frontage was thought to go through an erosive period around once every 30 years (Haskoning, Oct 2010) but analysis of the aerial photography has shown that an erosion event had taken place some time before 2005 (in addition to the 2010 event) where the gabions were seen to be exposed (where they were not in previous years) and the beach narrowed with scour to the north at the undefended cliffs. There are no beach profiles surveyed at this time and location to support this event but it could be assumed that such major events are more frequently experienced than has been stated previously.

An erosive trend could be picked up in some of the profiles in the run-up to the major storm event of June 2010, for example S1B8F, S1B8H and S1B8I all showed severe erosion in winter 2010 which was then followed by further scour in summer 2010. This meant that the previously eroded beach toe did not have the sediment available to dissipate the oncoming wave energy from the major storm event in summer 2010 when it occurred.

Comparisons of profiles S1B8H and S1B8I in the gabion frontage with profiles further south at S1A1A, B and C do not appear to show any linkage patterns in terms of erosion/accretion where for instance, the southern beach is accreting and the gabion frontage is eroding and vice versa. Also comparisons were made between S1A1 (in the deposition and geobag frontage) with profiles further south at S1A1A and B and no patterns of erosion/accretion were found there.

The behaviour of the beach south of S1A1A, where the beach becomes much broader again, shows progressive erosion of the foreshore as far as S1A1C and then from S1A1D accretion of upper beach and intertidal area from 2009W (the start of this profile's monitoring period). Further south from here profiles S1A1E, F, G, H, I and S1A2 also show progressive erosion.

Although the predominant processes along this frontage are from north to south there is evidence in profile analysis of sediment movement from the gabion frontage to the Ness (northward drift). For instance at S1B8E located on the Ness, between 2010W and 2010S there is massive accretion of sediment of around 40m seawards, corresponding simultaneously with the erosion event at S1B8H in 2010S where large amounts of sediment removal took place at the toe of the cliff. This relationship is also displayed by S1B8G with removal of sediment at the cliff face and toe between 2010W to 2010S and borne out by aerial analysis (2009 to 2010) which shows erosion at the undefended cliff closely related to accretion at the south end of the Ness.

It was often difficult to identify donor sites from the monitoring data of the Ness, with only a couple of profiles clearly showing an area that could have been an area of potential sediment removal at the foreshore berm (for example S1B8D shown in Appendix B6). However, in addition to this, sites in the donor area showed that February (post-recycling) beach levels were often higher than January (pre-recycling) beach levels at the berms.

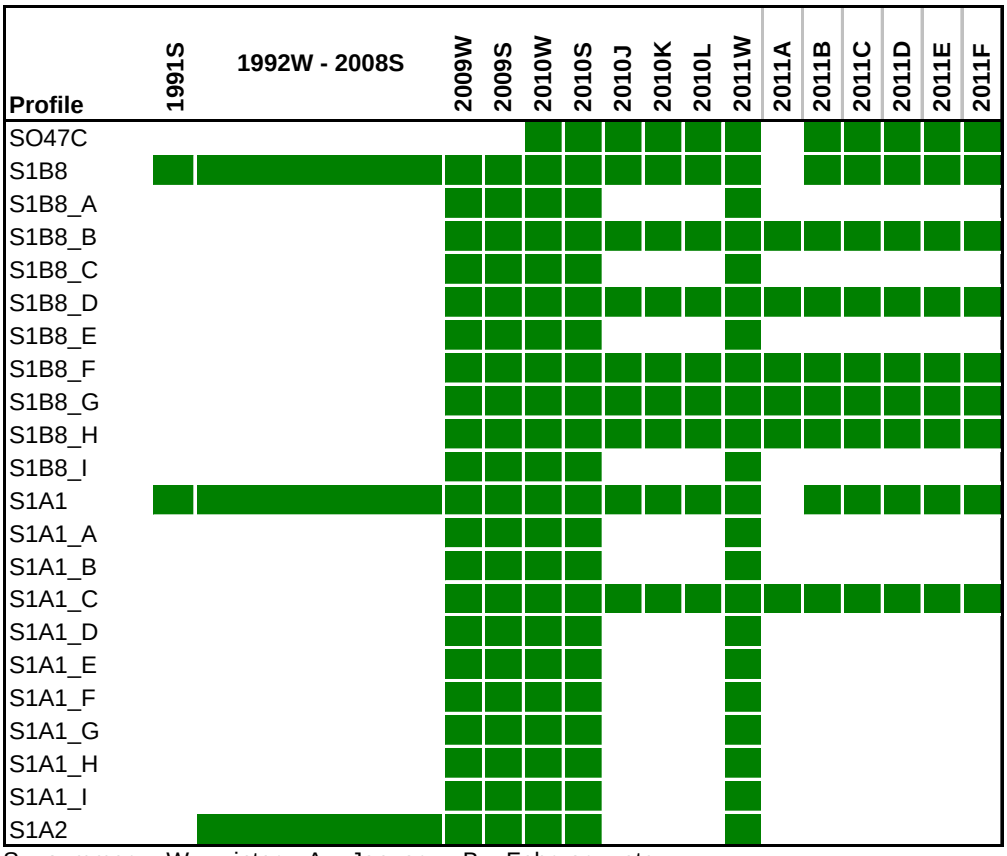
The Royal Haskoning Report, (November 2010) described the maximum depth of excavation to be limited to 0.7 m with tapering to 0m at its edges. There is also a time delay following excavation activities with profiles surveyed end of month, (and recycling taking place 8 – 11th February). For these reasons there is therefore little evidence of beach extraction with relatively little beach material being removed and equally there are no detrimental effects shown on any adjacent lengths of beach. Survey lines may also not have picked up where the bulk of the sediment was taken.

Analysis has shown that the beach face at the Ness appears to have the ability to recover almost immediately during constructive wave conditions rebuilding the berms after recycling activities have taken place.

The Royal Haskoning Report (October 2010) stated that the current erosion is a local issue which managed locally would be unlikely to impact on the broader sediment drift and beach behaviour north and south. And so far removal of sediment for recycling has not appeared to impact on adjacent lengths of the shore.

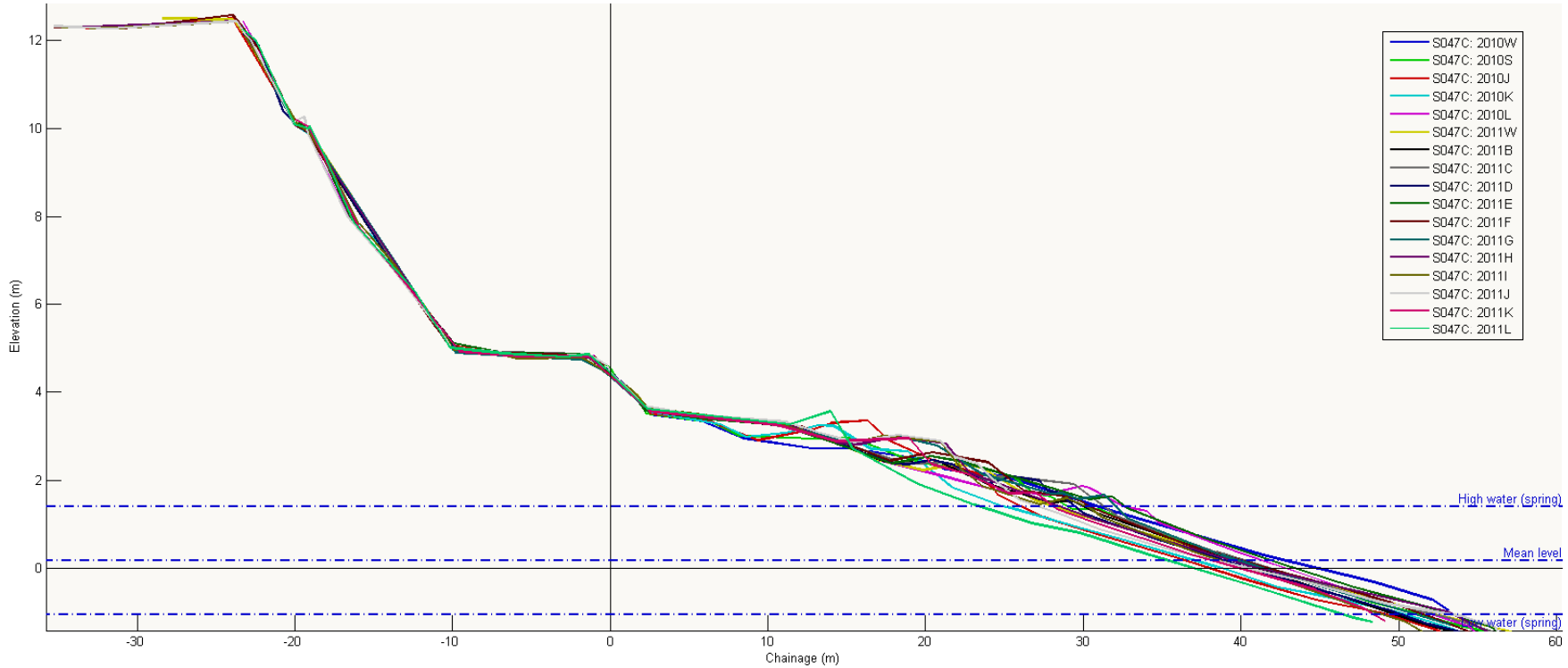
There was also no visible impact on vegetated shingle areas on the backshore of the Ness within the SSSI area.

Appendix A – survey dates

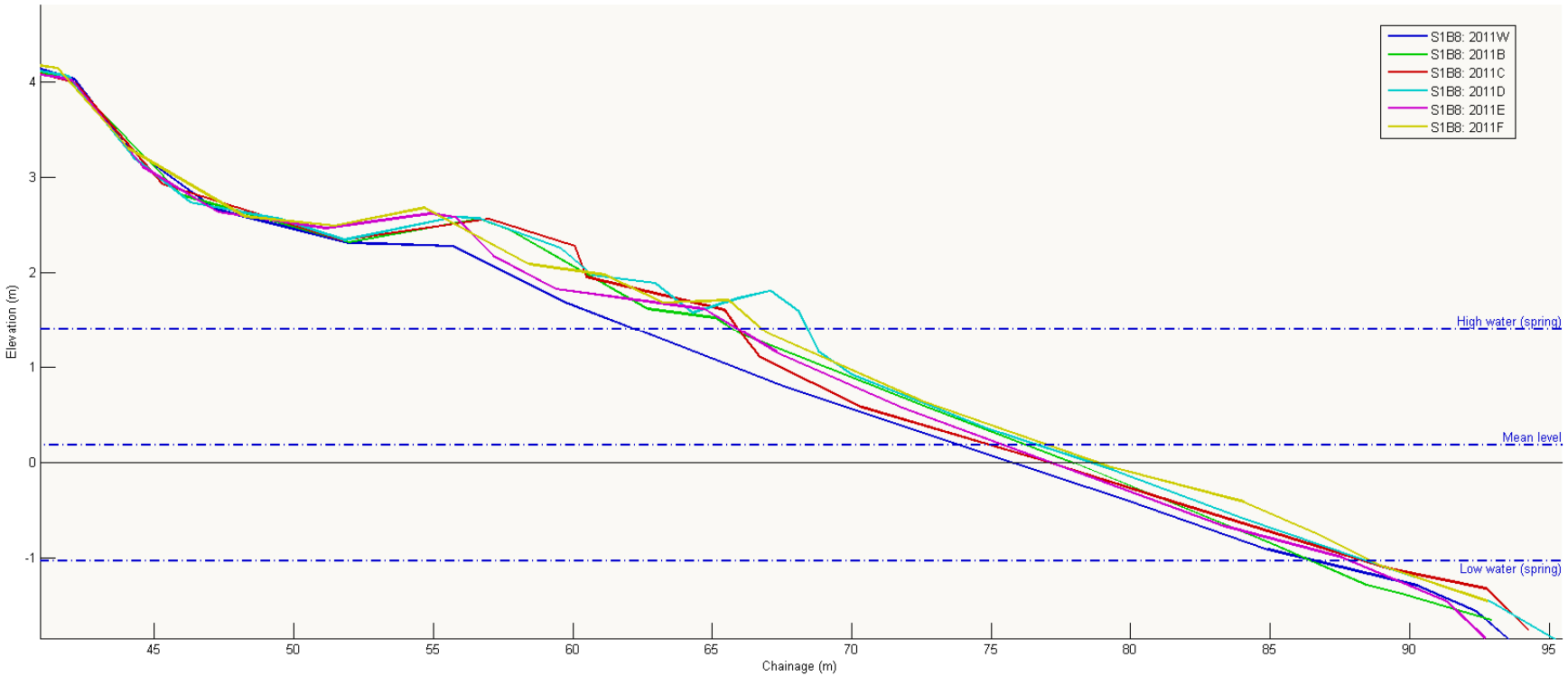


S = summer W = winter A = January B = February, etc
- green squares indicate surveyed dates

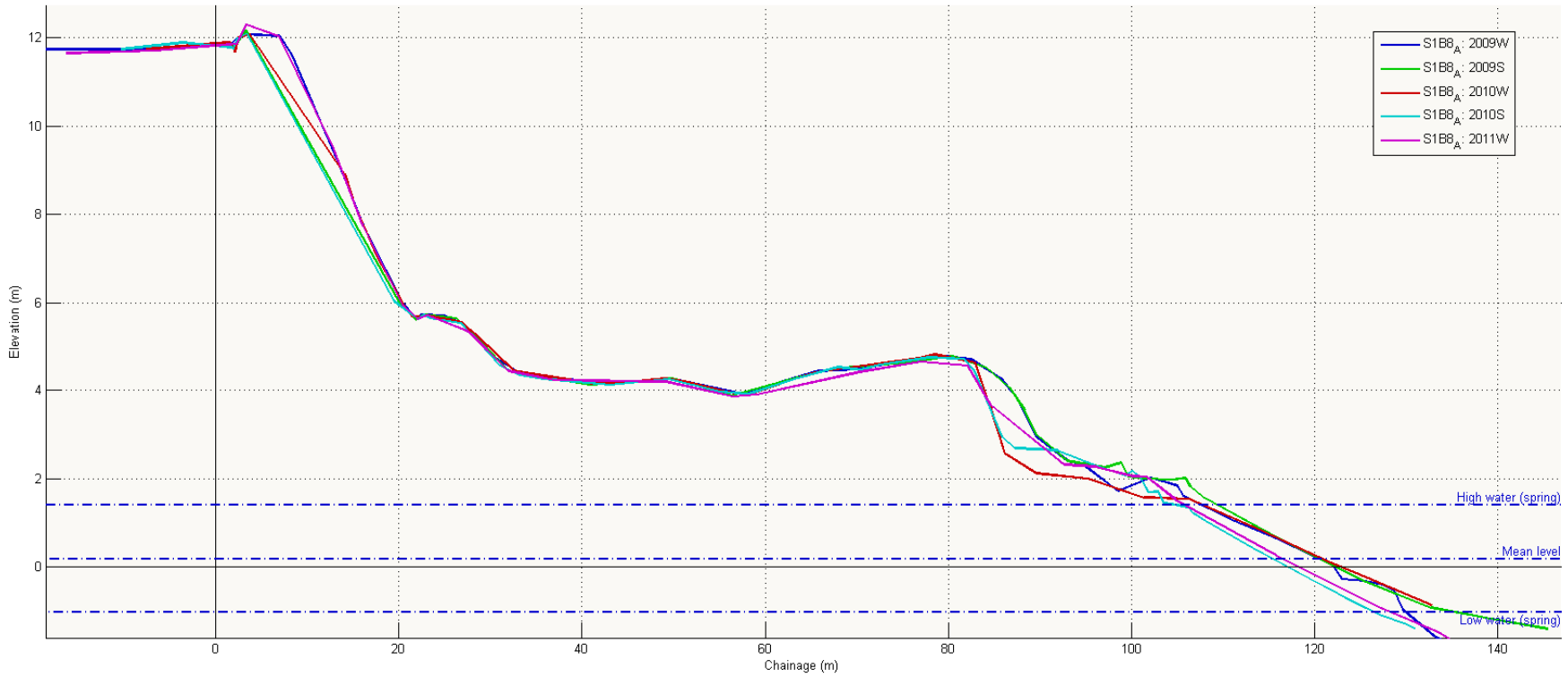
Appendix B – profile cross-sections



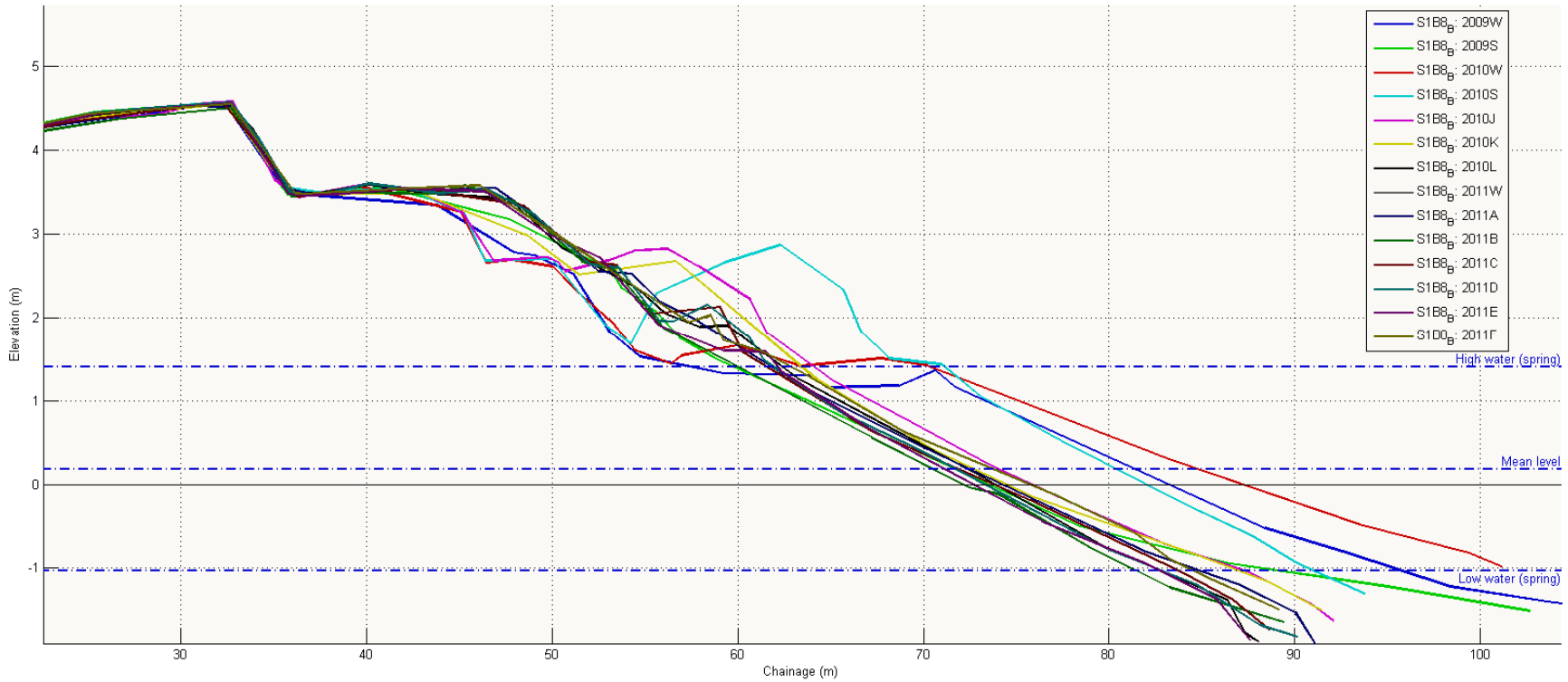
Appendix B1 – S047C shows a stable beach profile with no obvious signs of the June 2010 storm event. The highest foreshore berm is shown in October 2010 (2010J – red line).



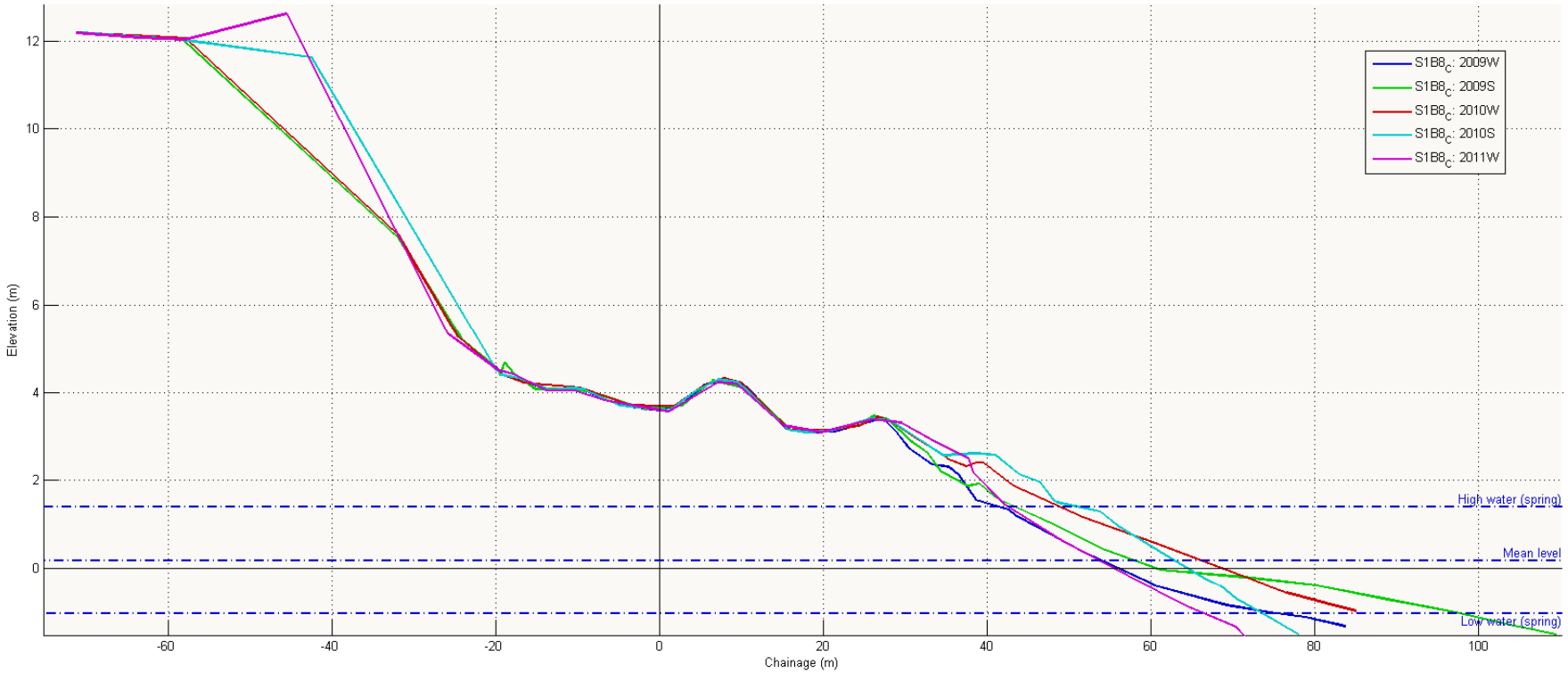
Appendix B2 – S1B8 intertidal area, showing accretion in the period January to June 2011 with the development of high water berms.



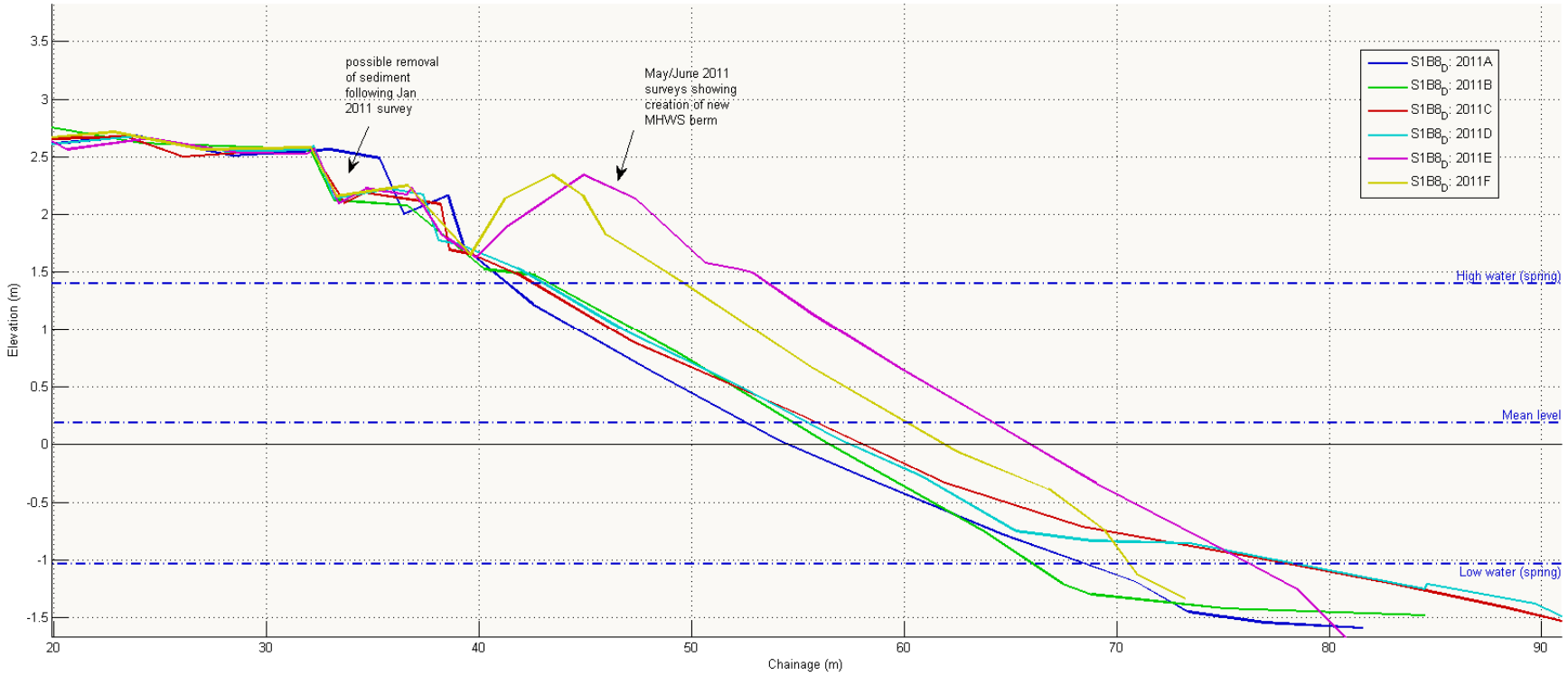
Appendix B3 – S1B8_A, showing a trough-shaped beach



Appendix B4 – S1B8_B intertidal area.. The distinct bar feature (in light blue) just above high water between January to July 2010, may have been as a result of the storm event in May/June 2010.



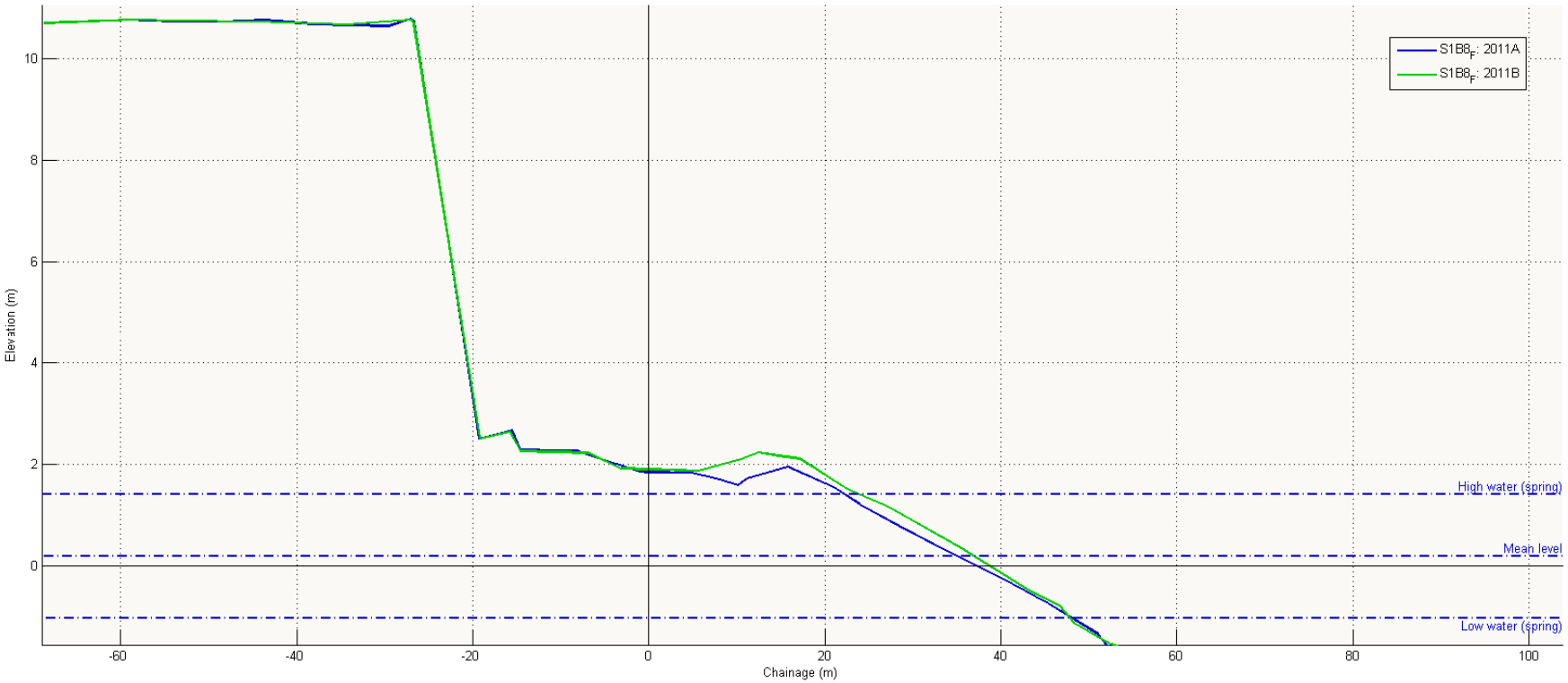
Appendix B5 – S1B8_C showing the midshore berm in the centre of the upper beach. There was seaward accretion in the beach face intertidal area from January 2009 to July 2010. Then following this the intertidal area retreated landwards by 10 metres to 2011W.



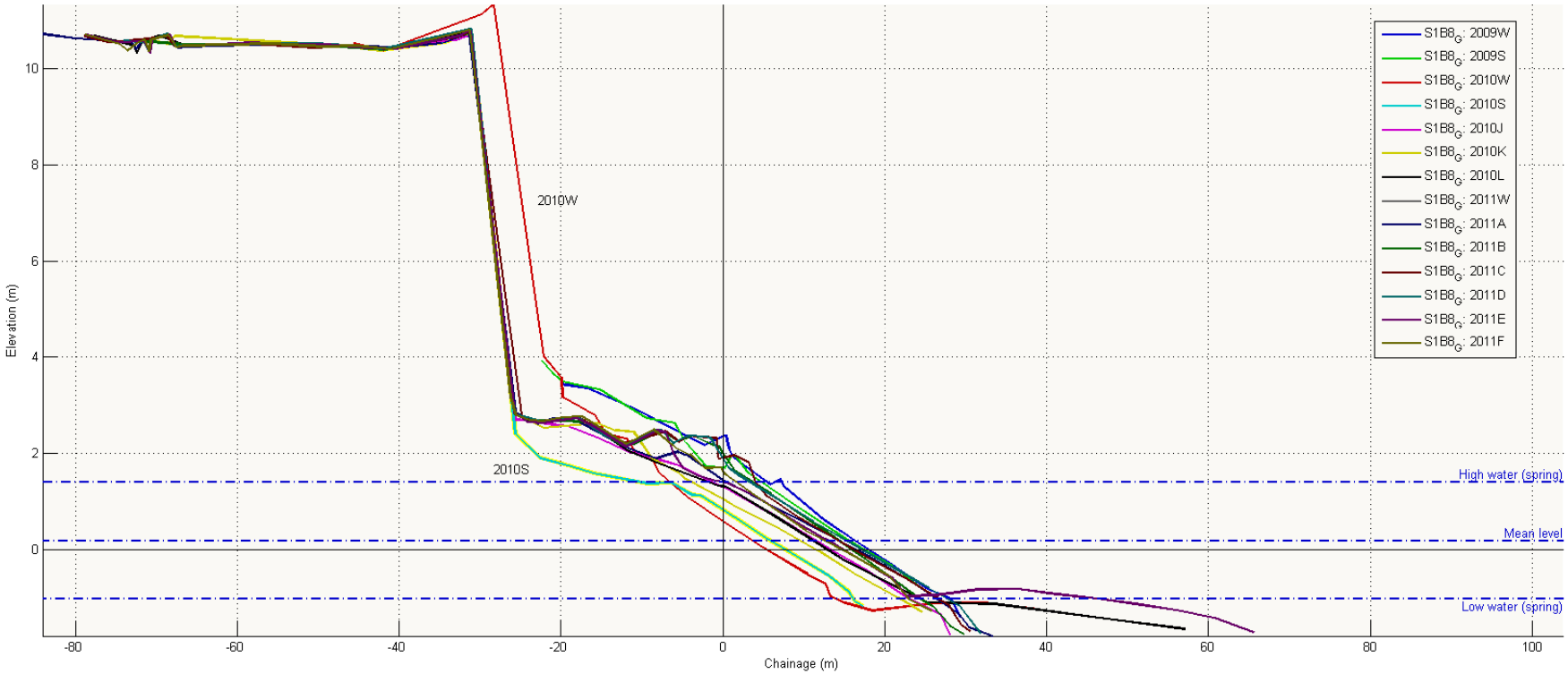
Appendix B6 – S1B8_D intertidal area showing possible sediment removal following the January 2011 survey. A new HWS berm has moved onshore by the May 2011 survey

Appendix B7 – S1B8_E profile showing beach levels between 2010W to 2010S extending seawards by 35 metres in the intertidal area with associated beach lowering at the toe of the cliffs.

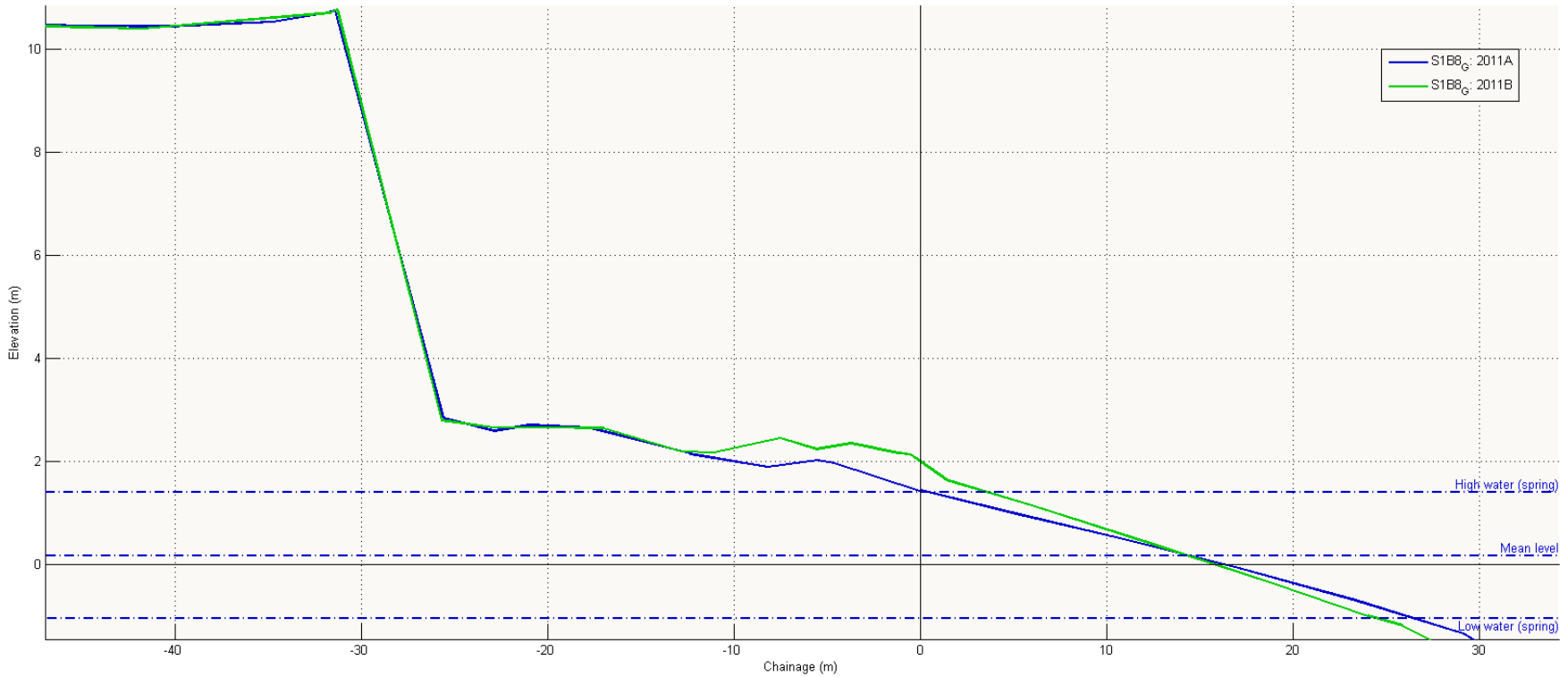
Appendix B8 – S1B8_F. The 2010W profile (in red) shows a distinct storm profile with beach drawdown and levels 3 metres lower at MSL. Beach levels have recovered by summer 2010 (in turquoise) with a berm at MHWS and lower beach levels behind this (in front of the cliffs).



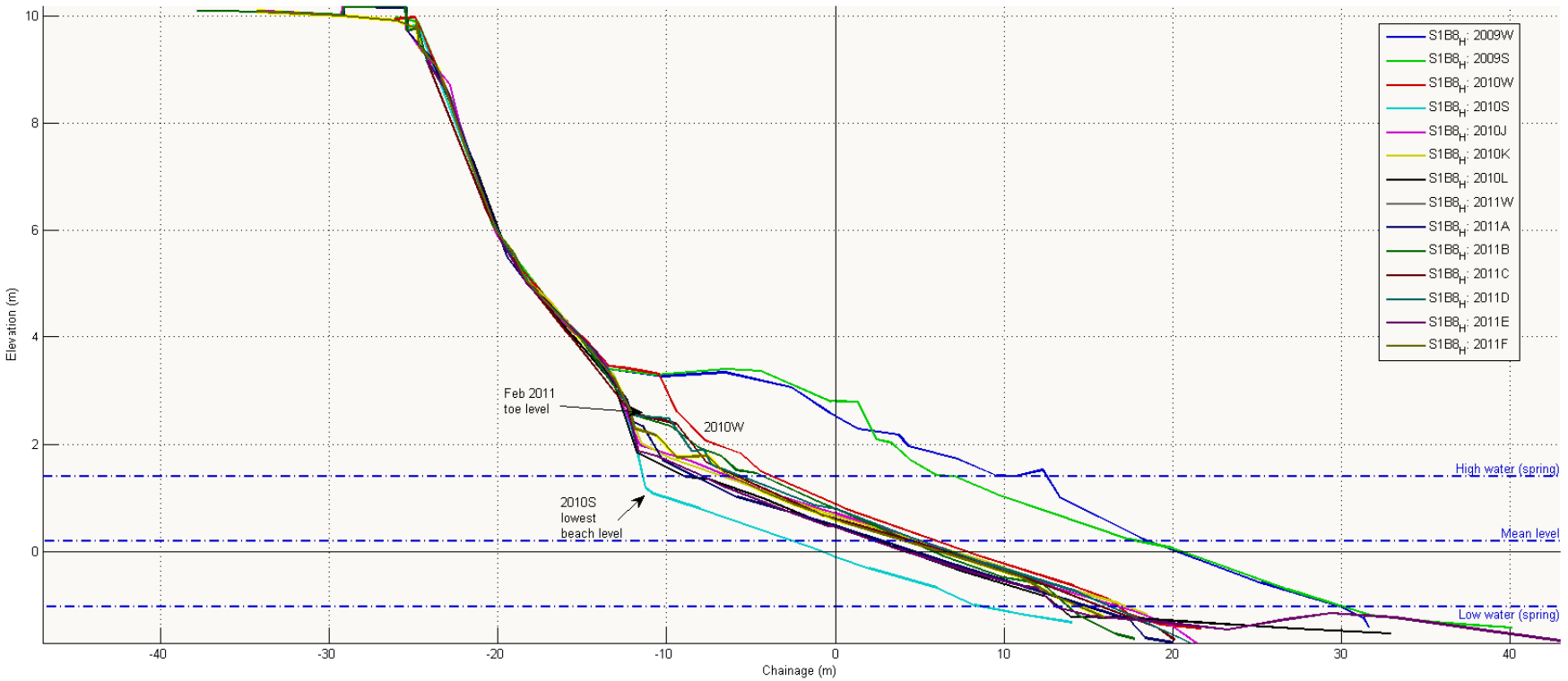
Appendix B9 – S1B8_F. Surveys for January and February 2011 show no evidence of beach lowering following sediment recycling works in February 2011.



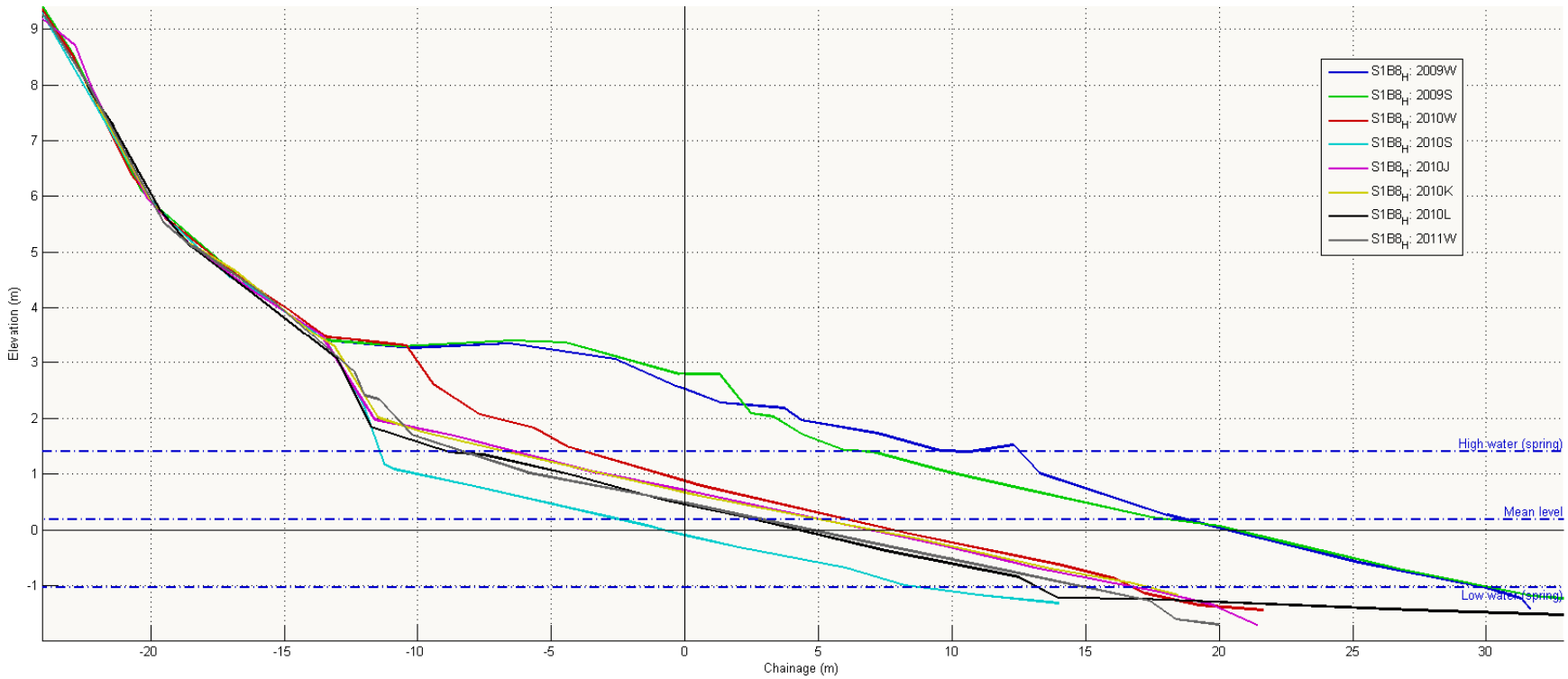
Appendix B10 – S1B8_G with 2010S highlighted. The vertical cliff face here retreats by 4.5 metres from 2010W to 2010S survey reflecting the storm event of June 2010, with beach drawdown evidenced along beach profile.



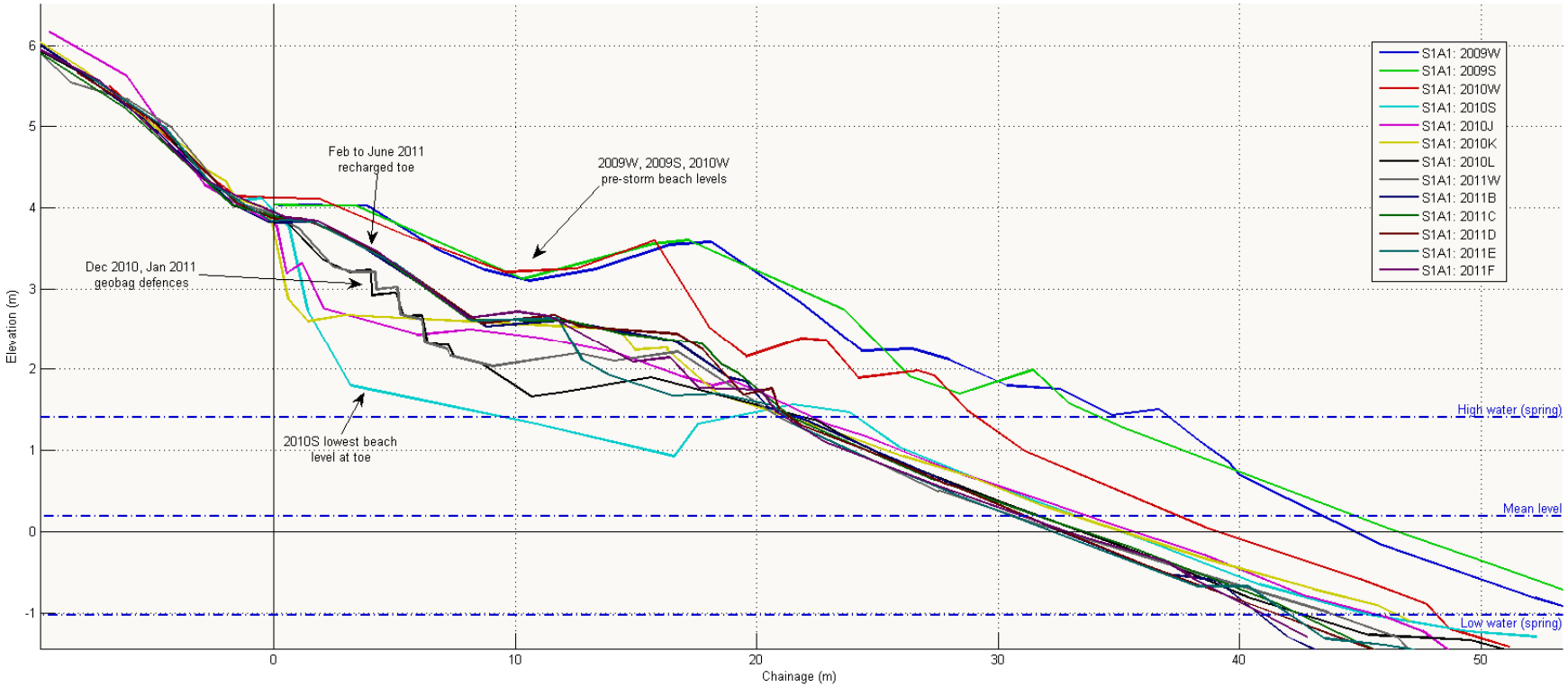
Appendix B11 – S1B8_G showing January and February 2011 surveys where a MHWS berm has accreted between January and February.



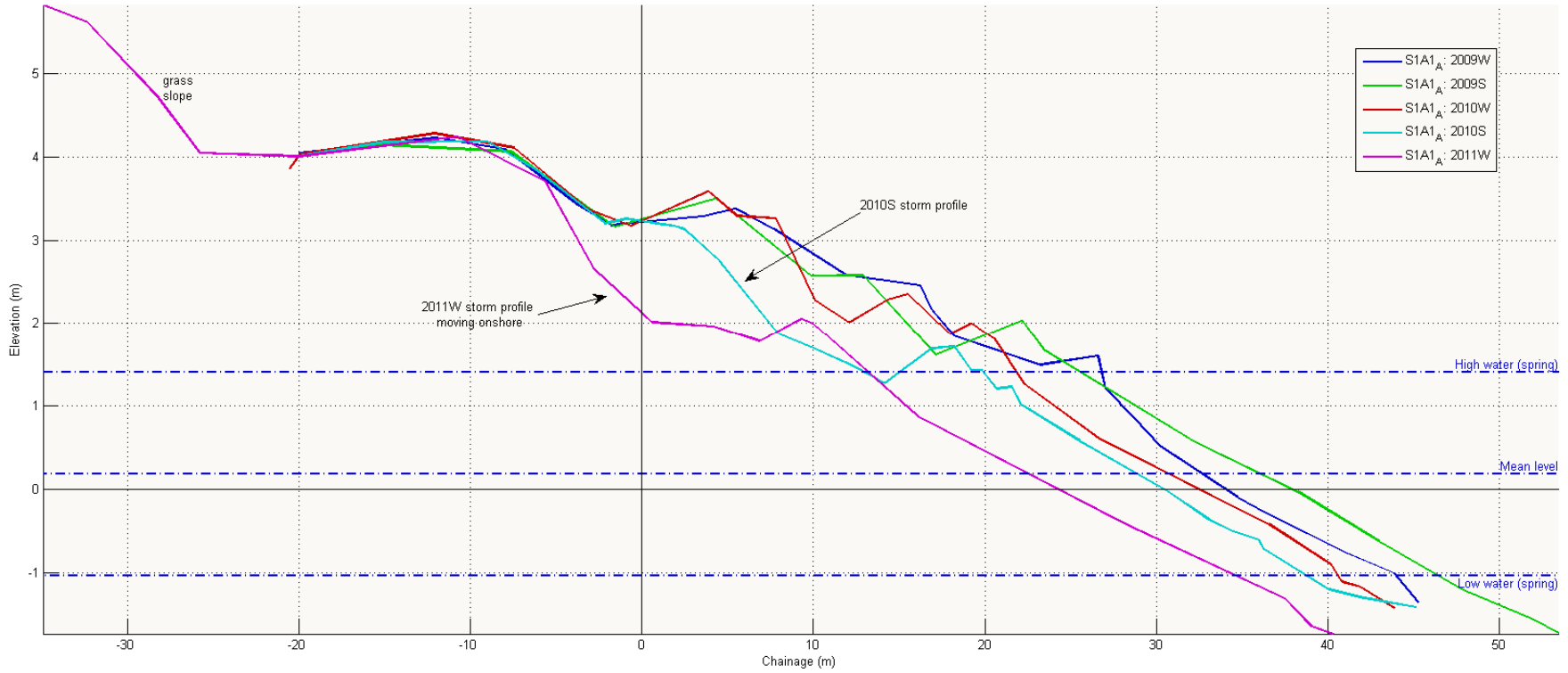
Appendix B12 – S1B8_H. The lowest beach levels at the toe of the gabions are observed in the summer 2010 profile. However, beach levels had already begun to recede prior to this, between 2009S and 2010W.



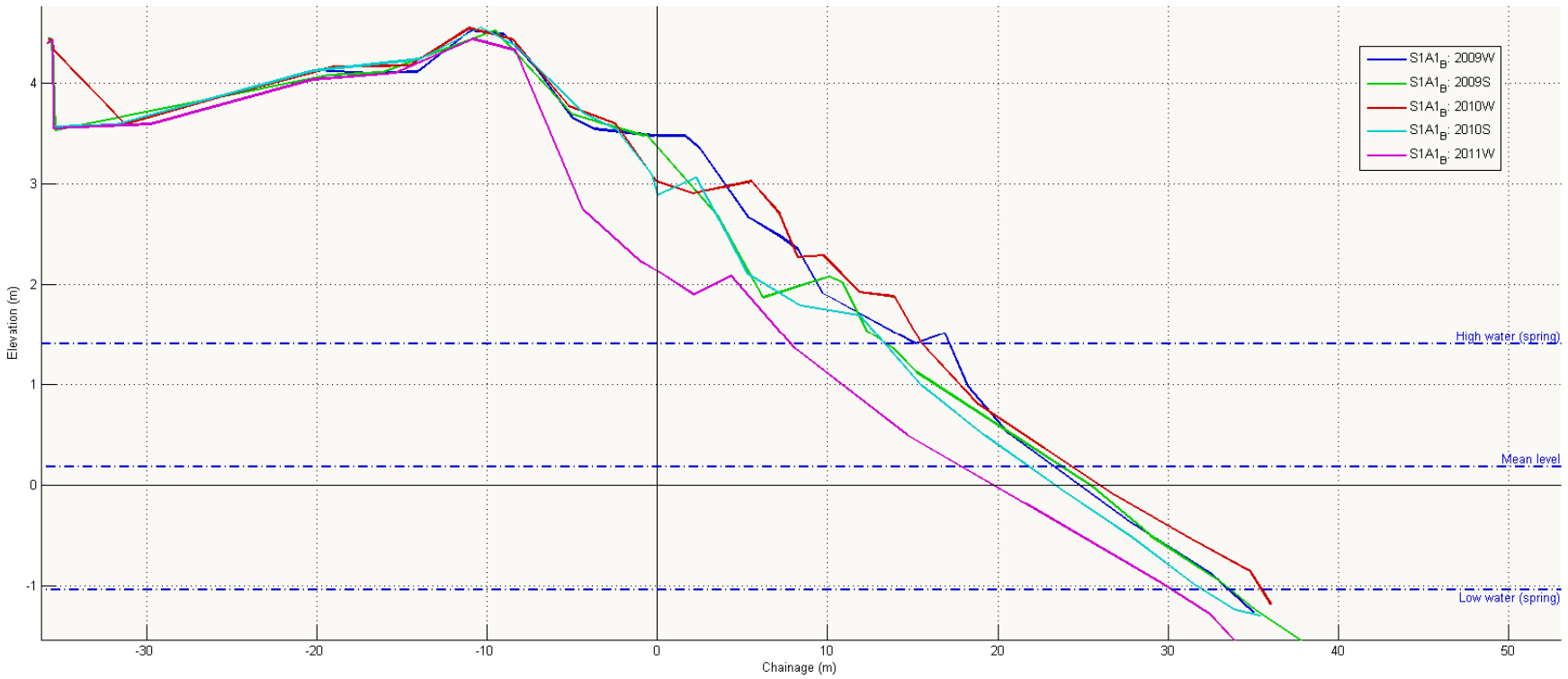
Appendix B13 – S1B8_I showing beach levels at their lowest in 2010S following the June storm event.



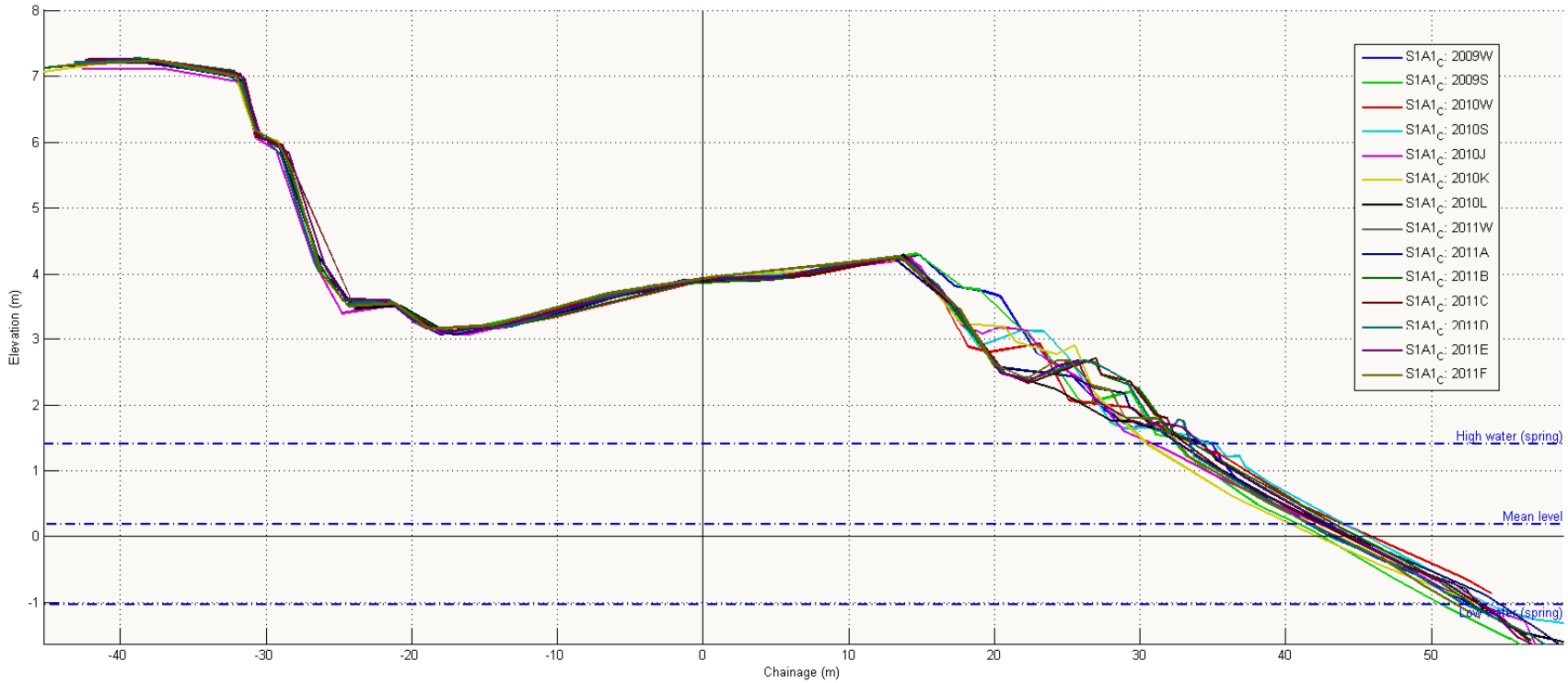
Appendix B14 – S1A1 from 2009W only, showing the lowest beach toe levels during the 2010 summer profile.



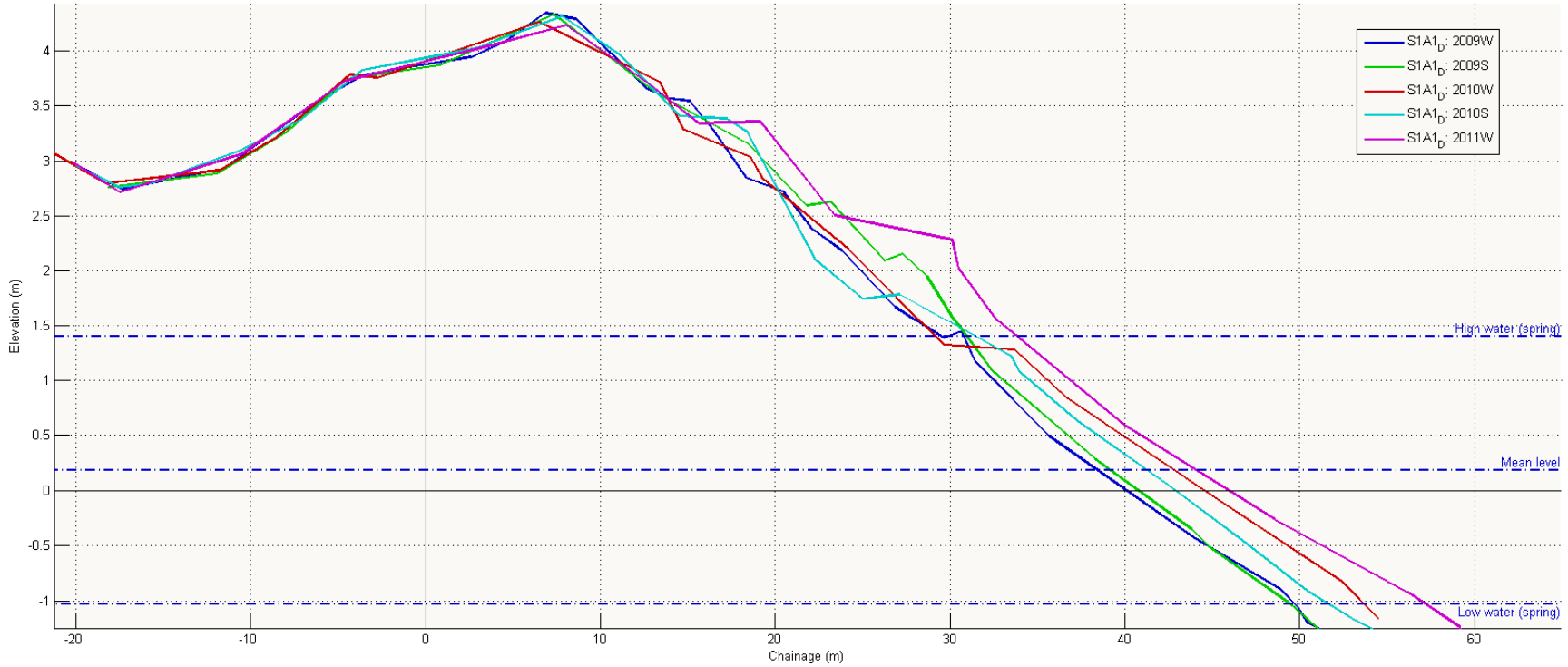
Appendix B15 – S1A1_A showing beach steepening and erosion south of the deposition frontage.



Appendix B16 – S1A1_B profile showing scour in the beach face and intertidal area in January 2011W survey

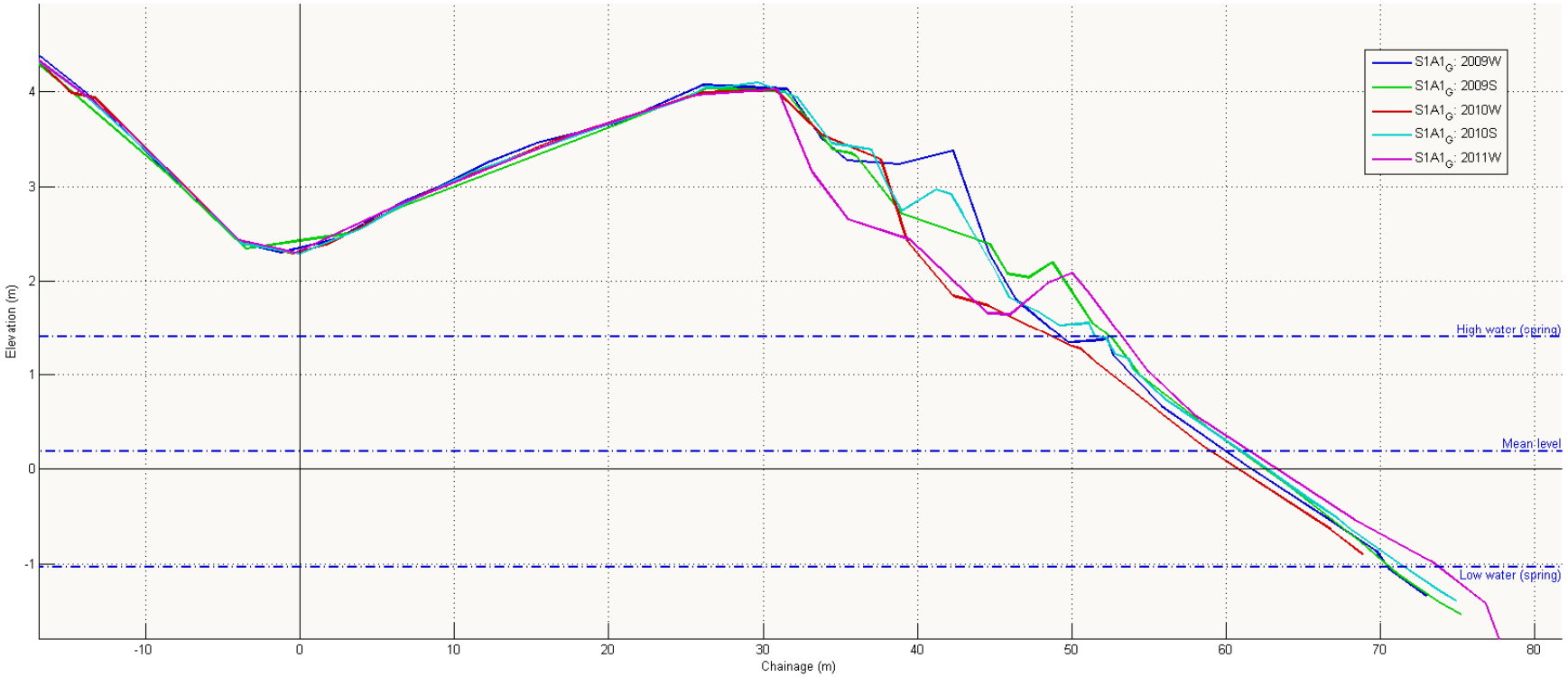


Appendix B17 – S1A1_C profile showing a return to a more trough shaped beach shape as experienced further north on the Ness and with erosion of the beach face from 2010W

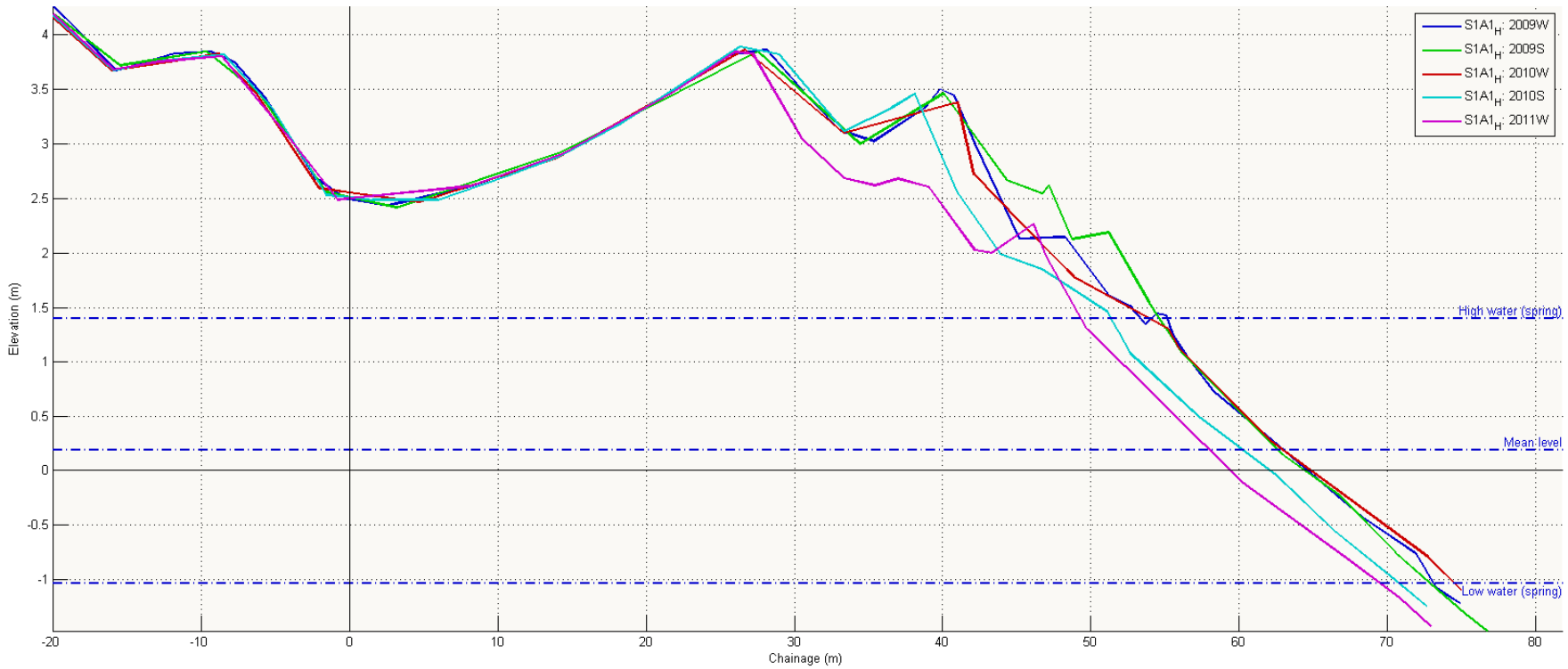


Appendix B18 – S1A1_D profile showing beach accretion to 2011W survey

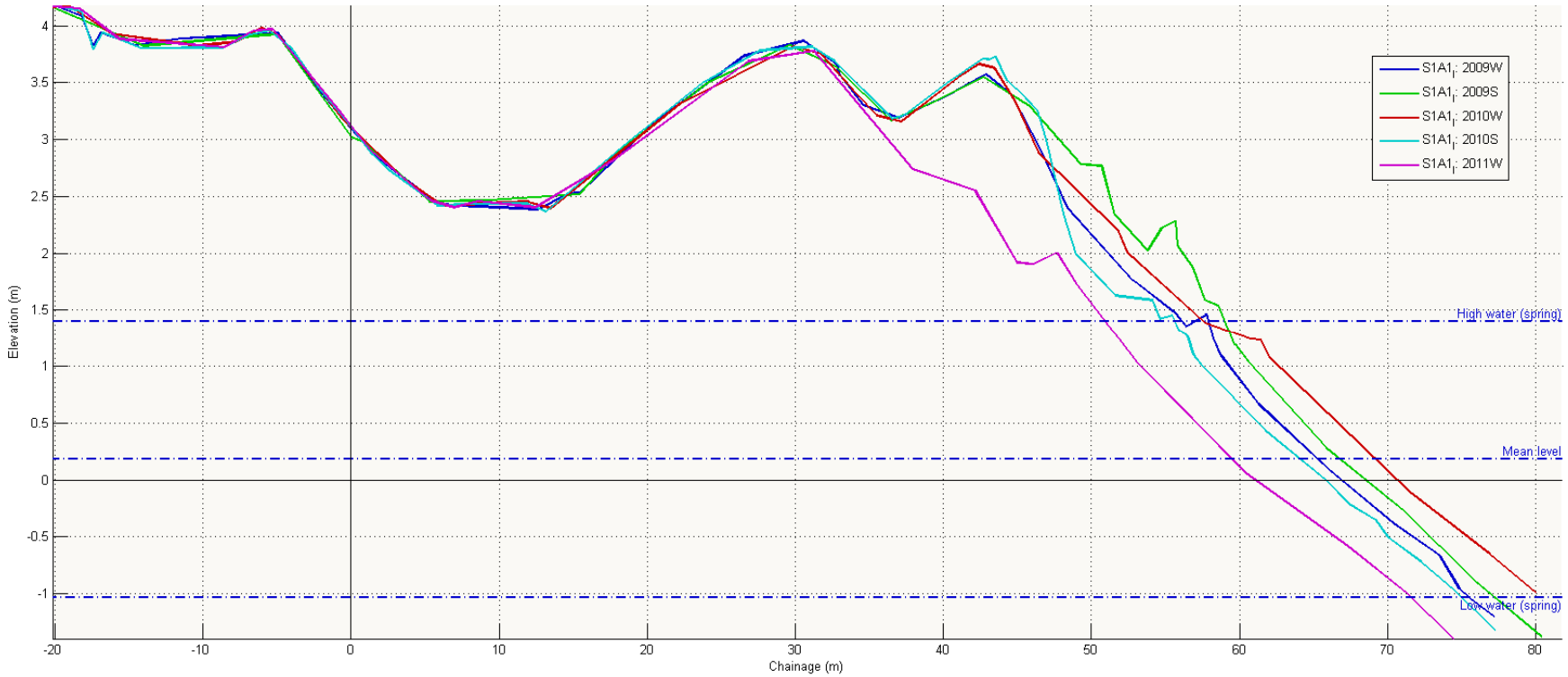
Appendix B19 – S1A1_E profile showing a trough shaped beach profile with an active beach face



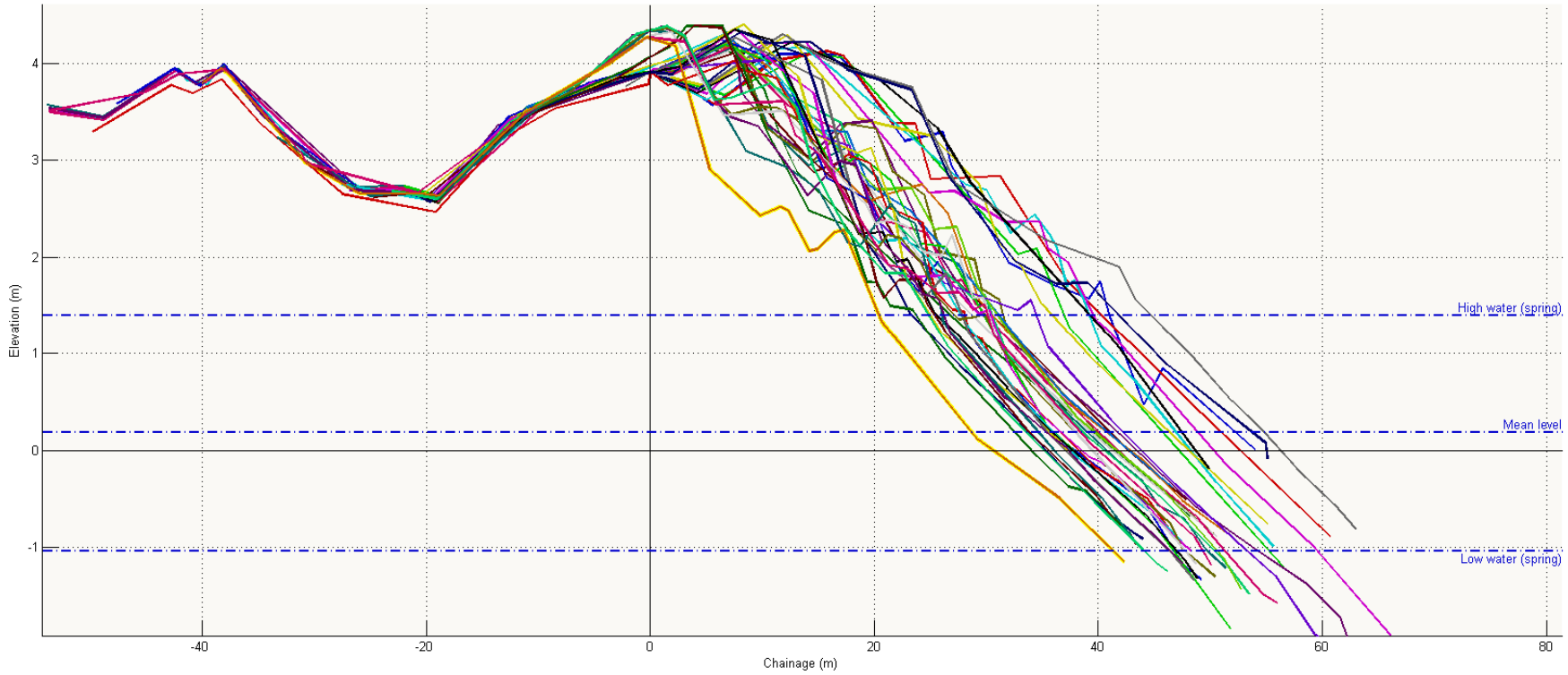
Appendix B20 – S1A1_G profile shows a trough shaped beach fronted by an active beach face with the most recent survey (2011W highlighted) showing a scoured beach face



Appendix B21 – S1A1_H. A typical trough shaped beach along the southern Thorpeness frontage with the beach face receding by around 10 metres to winter 2011.



Appendix B22 – S1A1_I. A typical trough shaped beach along the southern Thorpeness frontage with the beach face receding by around 10 metres to winter 2011



Appendix B23 – S1A2 – surveyed since 1992W, this profile clearly shows a mean erosion trend of 0.8 m/yr with the foreshore retreating landwards at a steady rate. The highlighted yellow profile is the most recent survey, 2011W

Appendix C – survey dates and quantities

Thorpeness Ness Excavation Quantities

Updated 13/09/11 SGD

Date	Volvo A25C Dump Truck. No of Loads	Volvo A25C Dump Truck. Vol. (m3)	Tracked Dumper. No. of Loads	Tracker Dumper Vol. (m3)	Vol. (m3)
08/11/2010	4	11			44
09/11/2010	4	11			44
14/12/2010			14	3.5	49
16/12/2010			4	3.5	14
17/12/2010			10	3.5	35
08/02/2011	25	11			275
09/02/2011	28	11			308
10/02/2011	20	11			220
				TOTAL	989

References

Royal Haskoning (Oct 2010) Thorpeness Erosion Response Works, Stage 1 Report

Royal Haskoning (Nov 2010), Principles for design and beach management – Thorpeness Erosion Response Works

Suffolk Coastal Trends Analysis (2011), Shoreline Management Group, Environment Agency

Suffolk Coastal District Council website (2011)

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