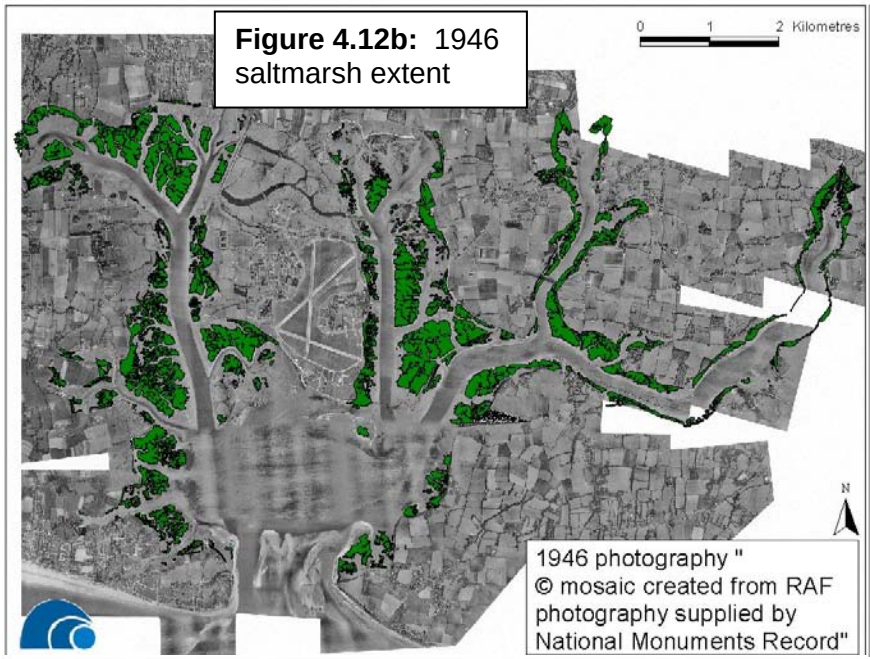


Figure 4.12b: 1946 saltmarsh extent

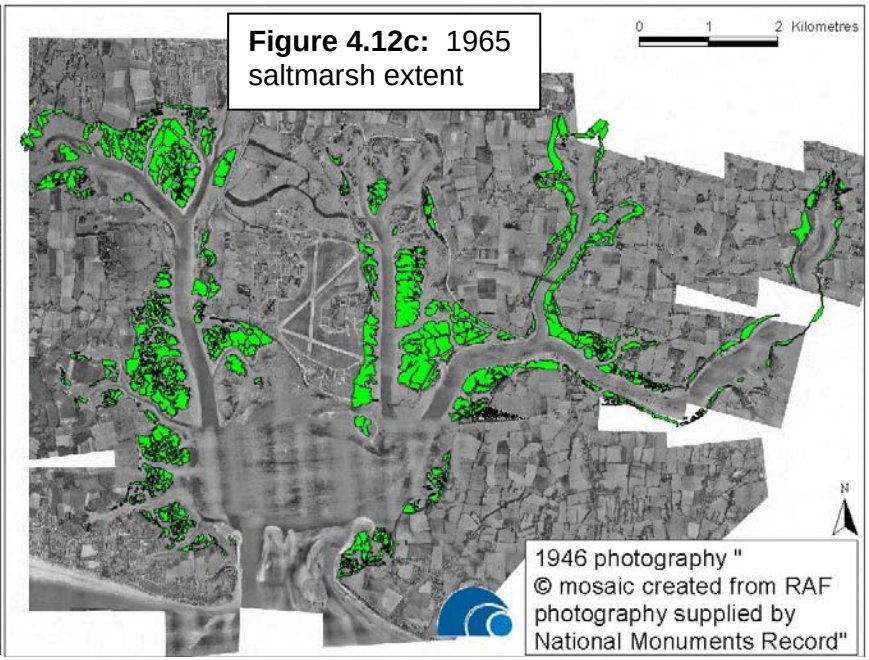


Figure 4.12c: 1965 saltmarsh extent

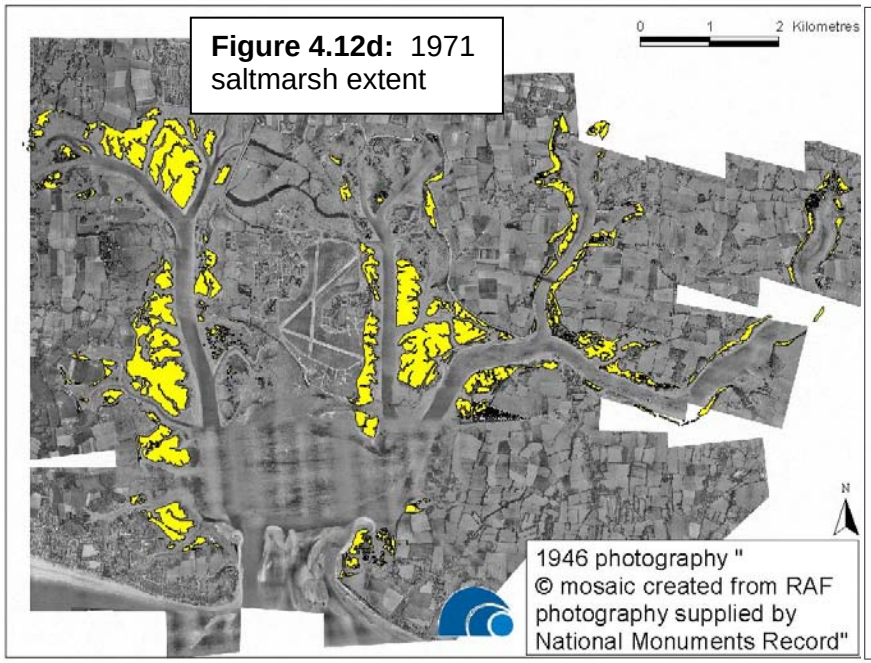


Figure 4.12d: 1971 saltmarsh extent

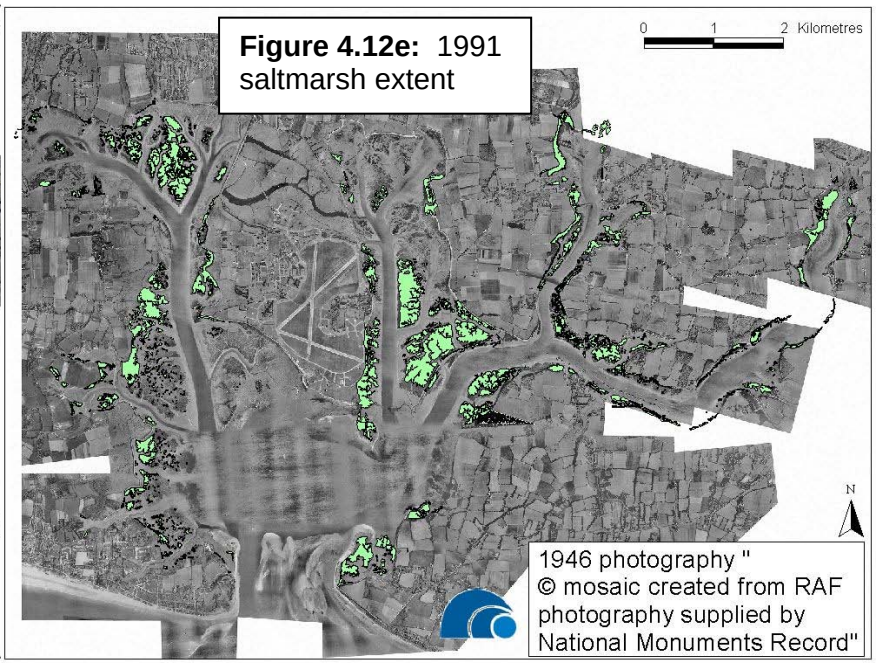


Figure 4.12e: 1991 saltmarsh extent

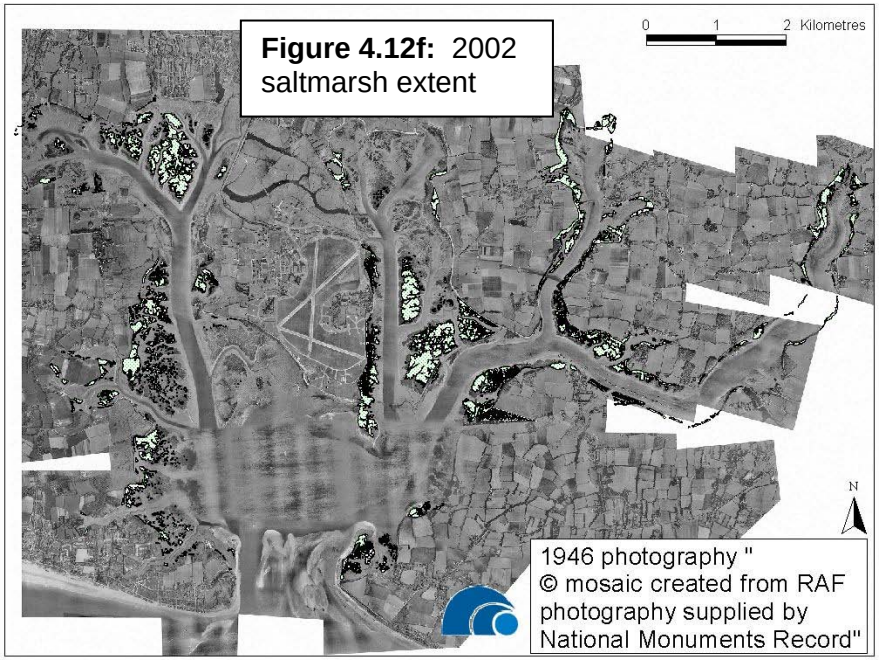


Figure 4.12f: 2002 saltmarsh extent

1946-2002 (Figure 4.11h and Table 4.13)

Between 1946 and 2002 the data shows 53% saltmarsh loss, this equates to 1% per annum. This is similar to Lymington and Beaulieu in the west Solent and Portsmouth Harbour, east Solent. The decline in saltmarsh occurred throughout the harbour with concentrations of loss on the western side. Still, the eastern side of the harbour underwent extensive edge erosion.

1946-1965 (Figure 4.11i and Table 4.13)

The data for this epoch indicates a relatively low rate of saltmarsh loss, at 0.5% per annum. Any loss is focused on the outer rim of the marshes, throughout the whole harbour.

1965-1971 (Figure 4.11j and Table 4.13)

Chichester Harbour underwent the highest rate of saltmarsh loss between 1963 and 1971, being 2.7% loss per annum. The highest rate of loss in Langstone was also between 1963 – 1971 at a rate of 6.4% per annum. Again, loss is apparent throughout the whole of Chichester Harbour but is particularly focused on the marshes south of Thorney Island.

1971-1991 (Figure 4.11k and Table 4.13)

The rate of loss between 1971 and 1991 reduced to 1.9% per annum. Loss is extremely noticeable on the western side of the harbour. One important thing to note is that the 1971 dataset was digitized by CHaMP to a coarser scale, thereby indicating more marsh than may have existed. In addition, the 1991 photography that CCO digitized was not at a good scale or resolution. Therefore, smaller patches of marsh may have been missed from the 1991 dataset as it was difficult to identify them. Both of these factors may have increased the amount lost.

1991 -2002 (Figure 4.11l and Table 4.13)

The rate of loss between 1991 and 2002 reduced significantly to 0.3% per annum. This is the lowest rate of saltmarsh loss for any epoch across the north Solent, along with Southampton Water which also underwent a 0.3% loss per annum between 1963 – 1971. Any loss is focused on the outer rim of the marshes. Internal dissection is also in operation as the marshes start to fragment in places.

The following Figures 4.12g – 4.12k show the spatial change in coverage between 1946 – 2002, 1957 – 1963, 1965 – 1971, 1971 – 1991 and 1991 – 2002 in Chichester Harbour.

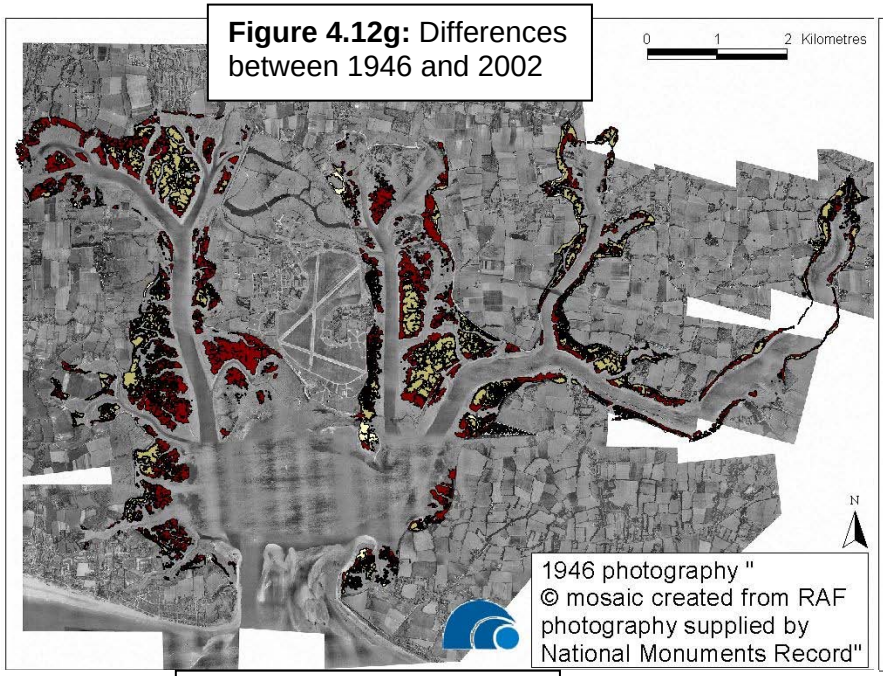


Figure 4.12g: Differences between 1946 and 2002

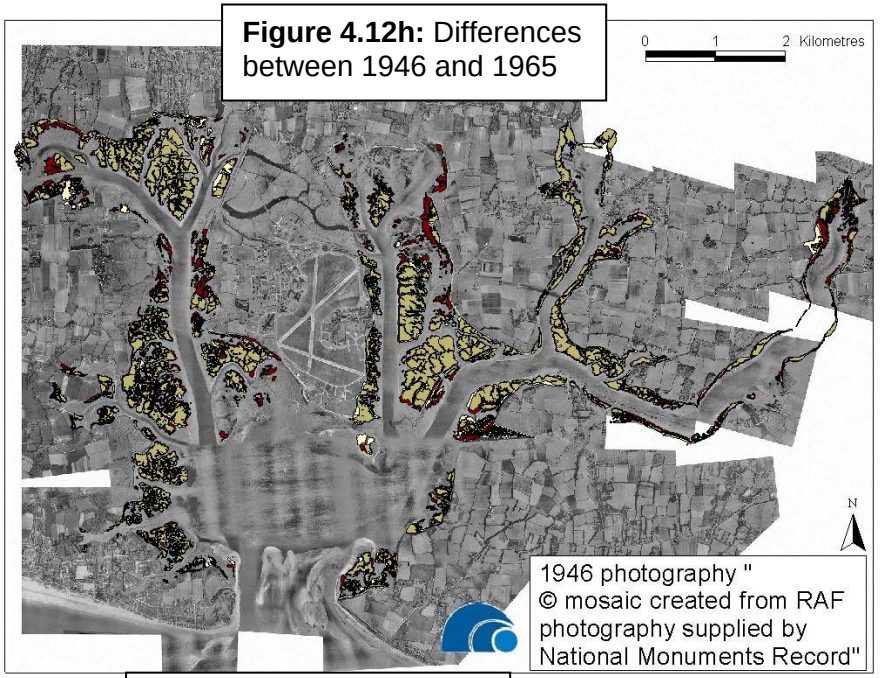


Figure 4.12h: Differences between 1946 and 1965

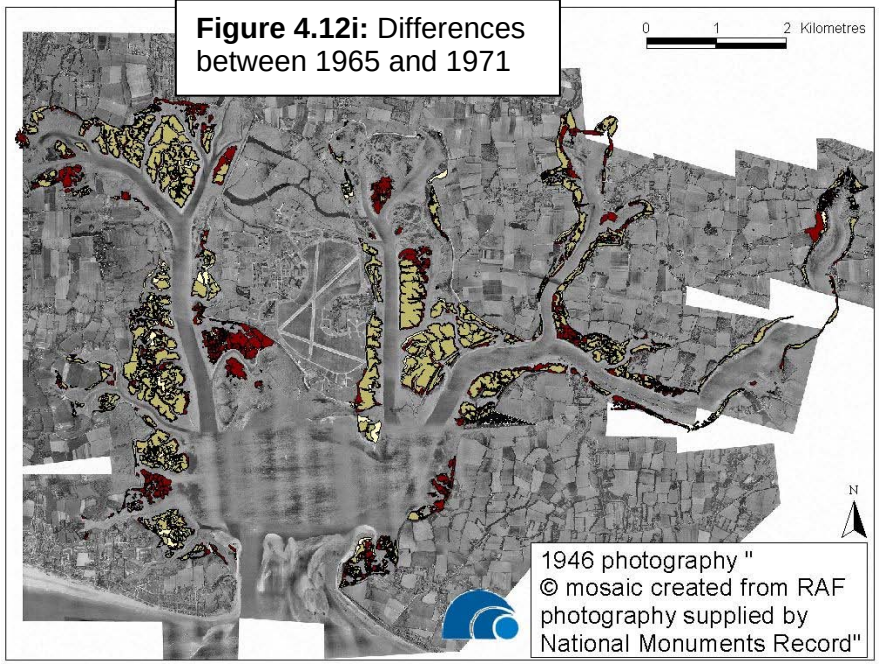


Figure 4.12i: Differences between 1965 and 1971

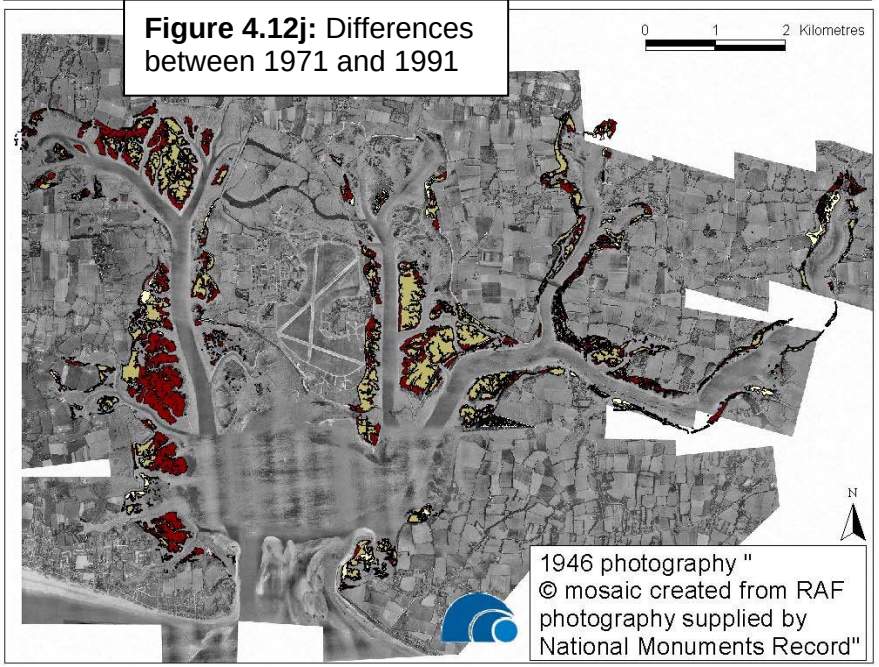


Figure 4.12j: Differences between 1971 and 1991

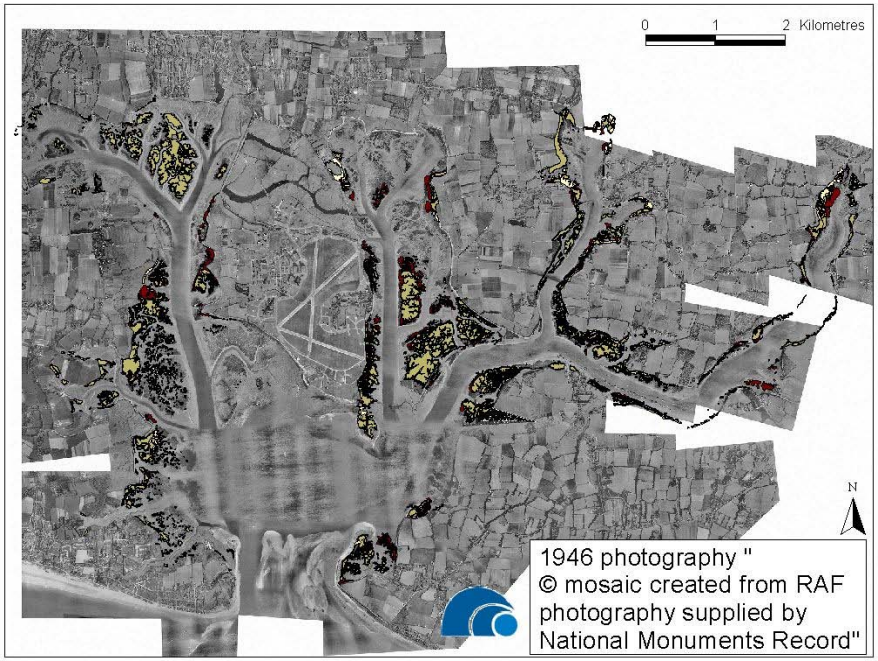


Figure 4.12k: Differences between 1991 and 2002

4.2.11.2 Predicted inter-tidal change

The following Figure 4.12l shows the area selected for LTEI calculations at Chichester Harbour for comparison with the HPI.

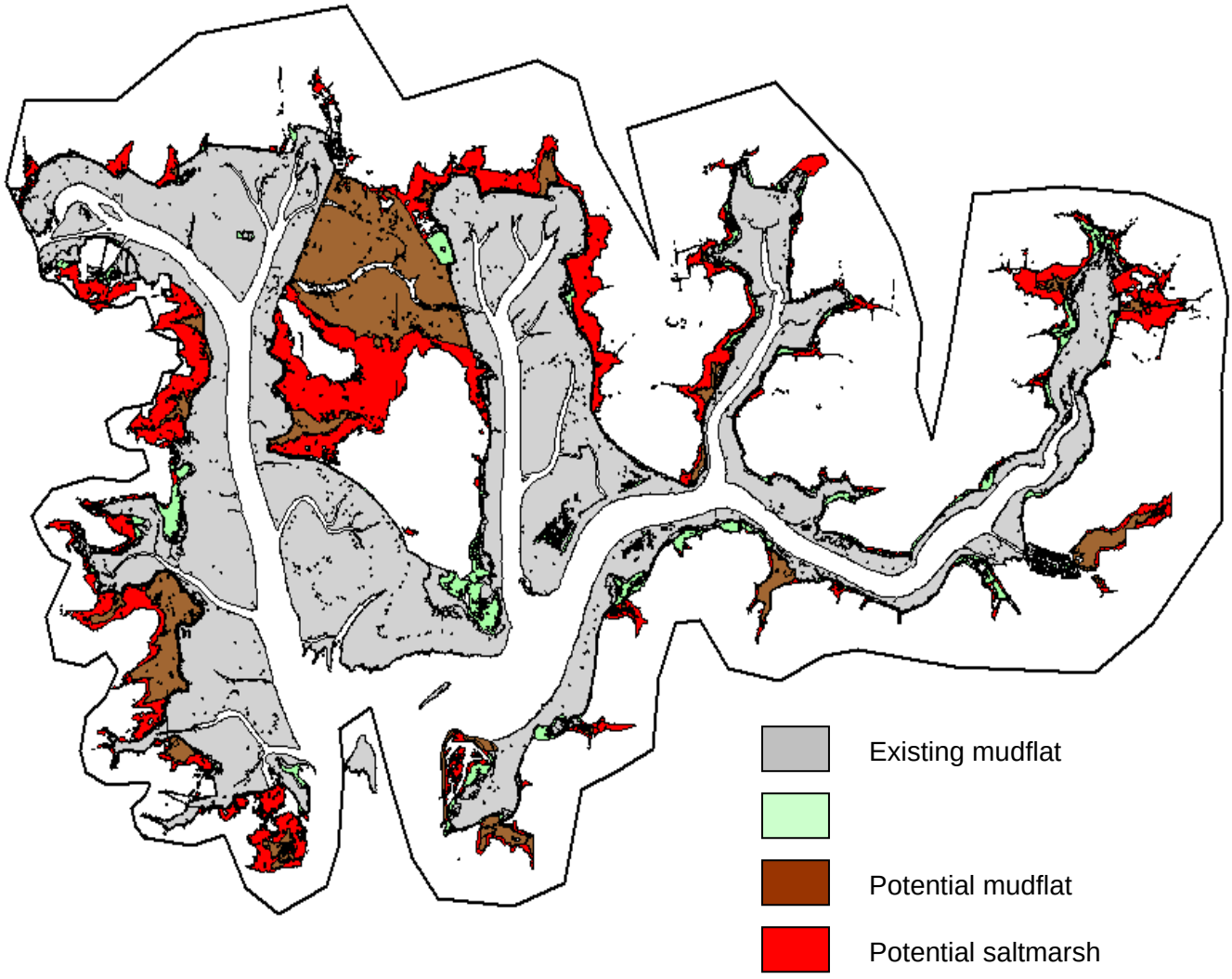
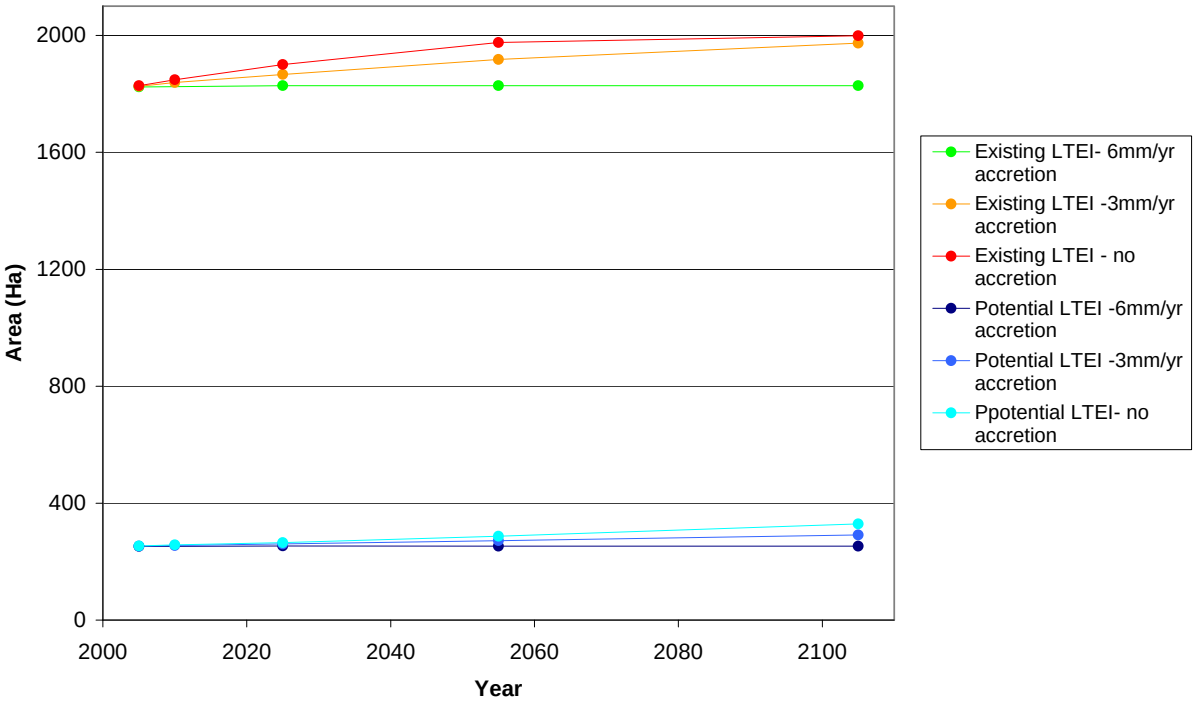
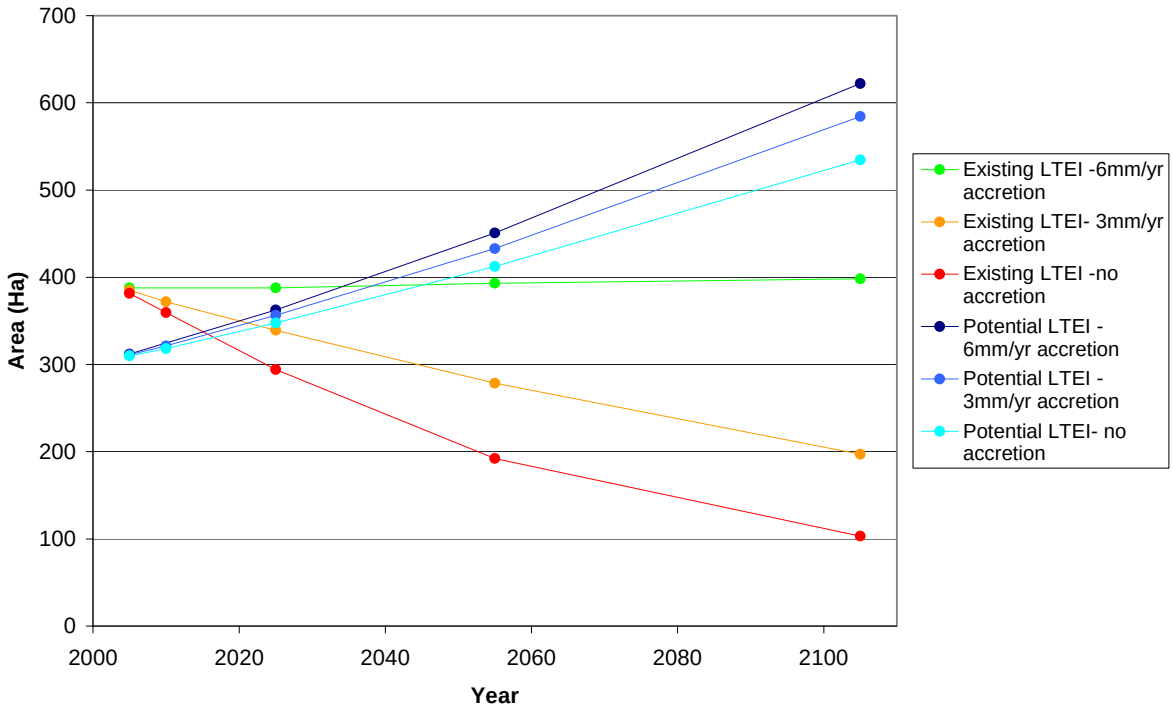


Figure 4.12l: Area selected for LTEI calculations at Chichester Harbour

Projected changes are presented for the "existing" management scenario (seawards of the seawall) and for "potential" increases in habitat areas arising from re-alignment (landwards of the seawall). Results are presented for mudflat (Graph 4.1b) and saltmarsh (Graph 4.1c), for the situation now, 5, 20, 50 and 100 years time for the no sediment accretion, 3mm and 6mm sediment accretion per annum LTEI scenarios.



Graph 4.11b: "Existing" and "potential" predicted mudflat extent in Chichester Harbour (from LTEI)



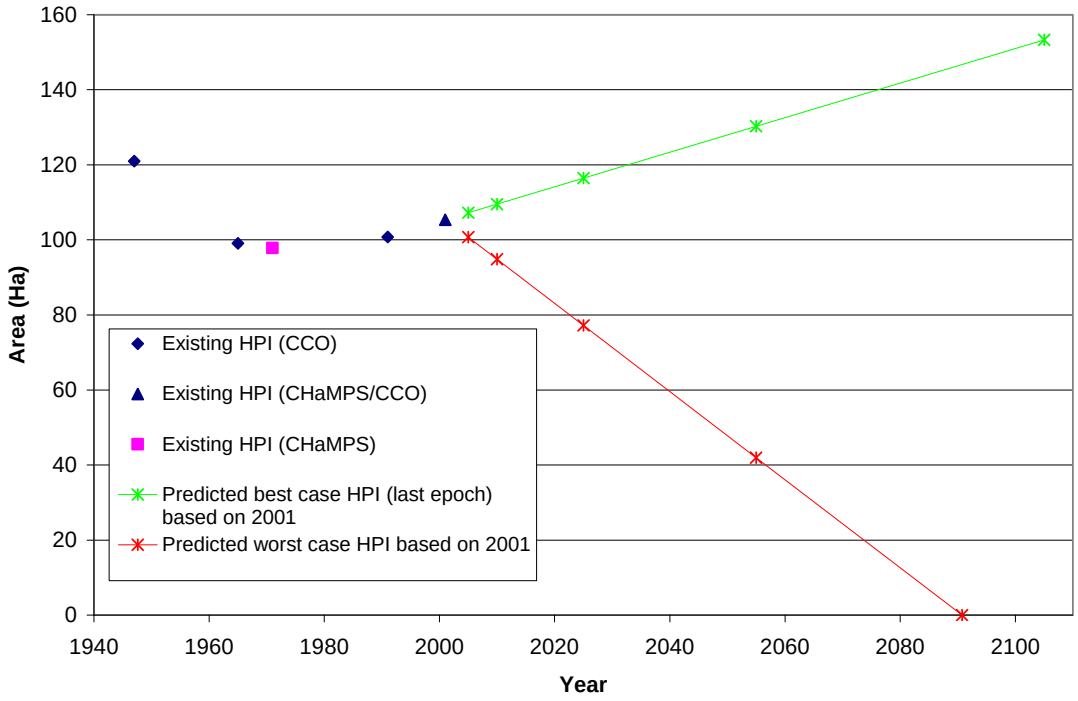
Graph 4.11c: "Existing" and "potential" predicted saltmarsh extent in Chichester Harbour (from LTEI)

Results show mudflat evolution under the existing management regime slightly increase through time (Graph 4.11b), as saltmarsh slightly decreases for the no sediment accretion and 3mm sediment accretion per annum scenarios (Graph 4.11c). In the event of re-alignment, saltmarsh has the potential to double over the next 100 years (Graph 4.11c).

4.2.12 Pagham Harbour

4.2.12.1 Historical saltmarsh change

The following show the total saltmarsh extent for 1947, 1963, 1991 and 2001 (CHaMP/CCO) Pagham Harbour based on the HPI (Graph 4.12a, Table 4.14 and Figures 4.13). The best, worst and last epochs were extrapolated for 2005, 2025, 2055 and 2015. Losses exclude reclamation.



Graph 4.12a: "Existing" saltmarsh extent in Pagham Harbour (based on HPI)

Graph 4.12a also shows the 1971 CHaMP value as this is the lowest area that the saltmarsh decreased to.

Year	Area (Ha)	Data Source	Period	Total Loss		Loss (excluding reclamation)	
				% loss	% loss per year	% loss	% loss per year
1947	121.0	CCO					
1965	99.0	CCO	**1947-1965**	18.1	1.0	17.5	1.0
1991	100.8	CCO	**1965-1991**	-1.7	-0.1	-2.0	-0.1
2001	105.4	CHaMP/CCO	**1991-2001**	-4.6	-0.5	-4.6	-0.5
			1947-2001	12.9	0.2	10.7	0.2

Table 4.14: Saltmarsh extent in Pagham Harbour (based on HPI)

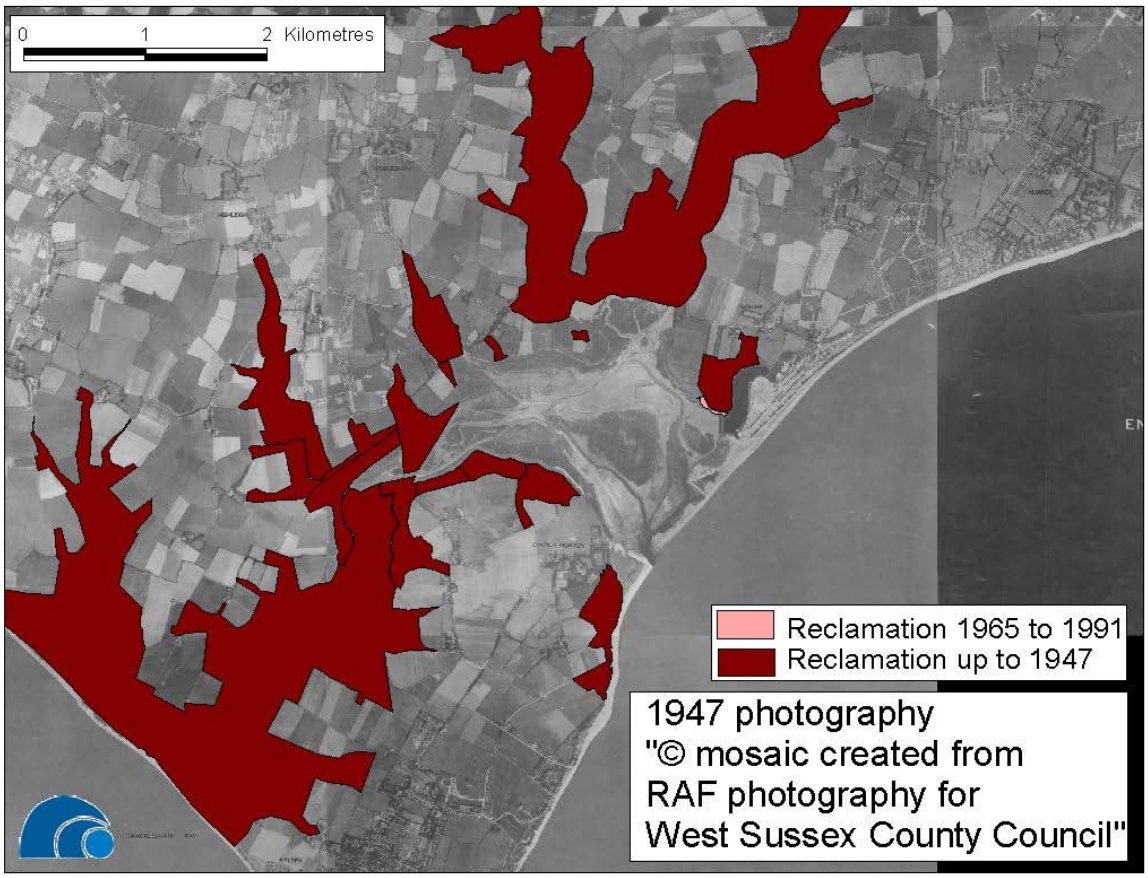


Figure 4.13a: Reclamation in Pagham Harbour (based on HPI)

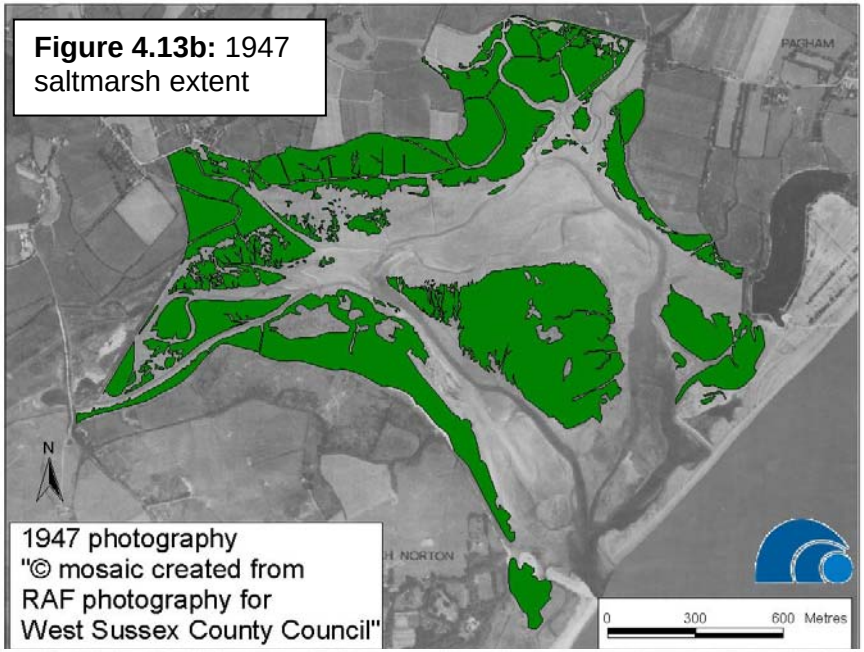


Figure 4.13b: 1947 saltmarsh extent

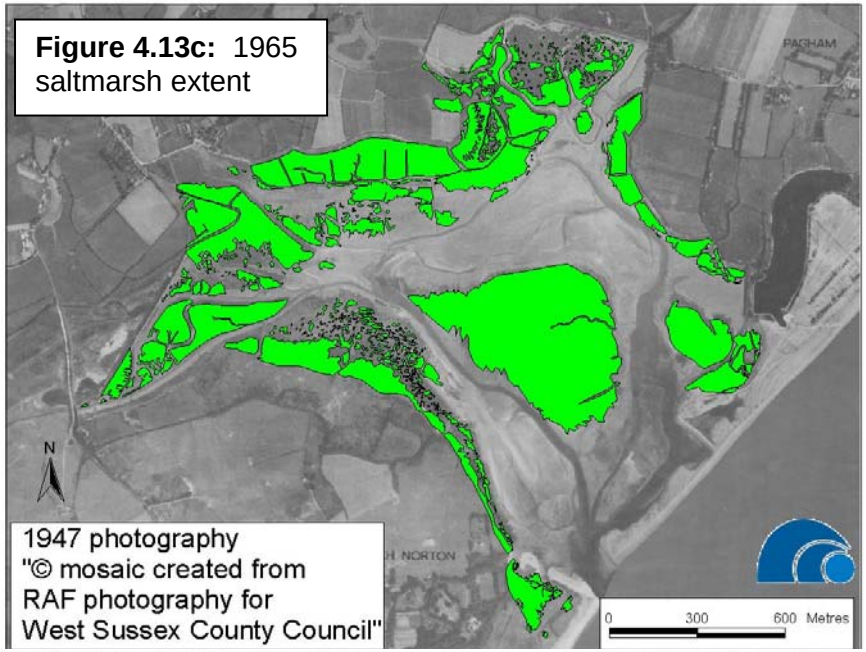


Figure 4.13c: 1965 saltmarsh extent

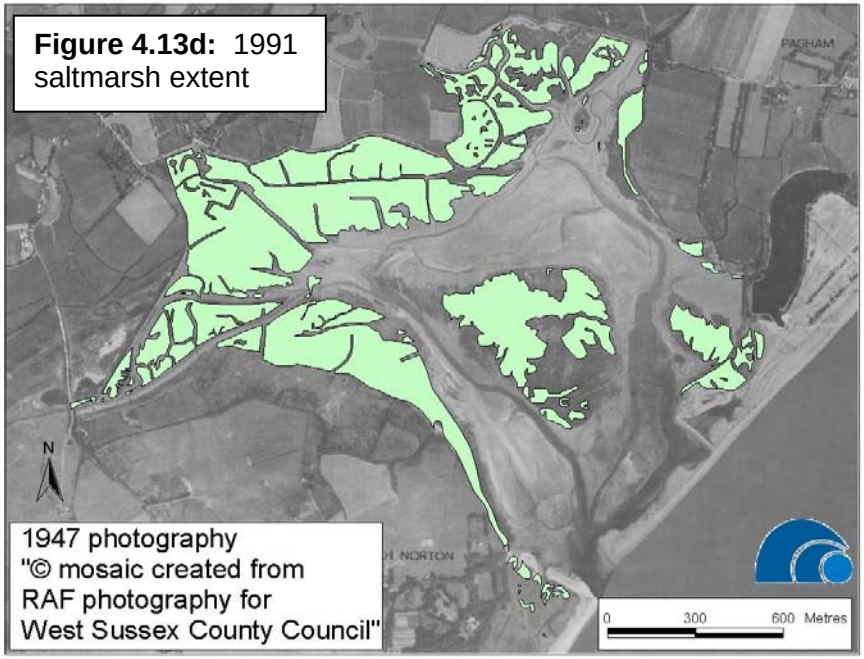


Figure 4.13d: 1991 saltmarsh extent

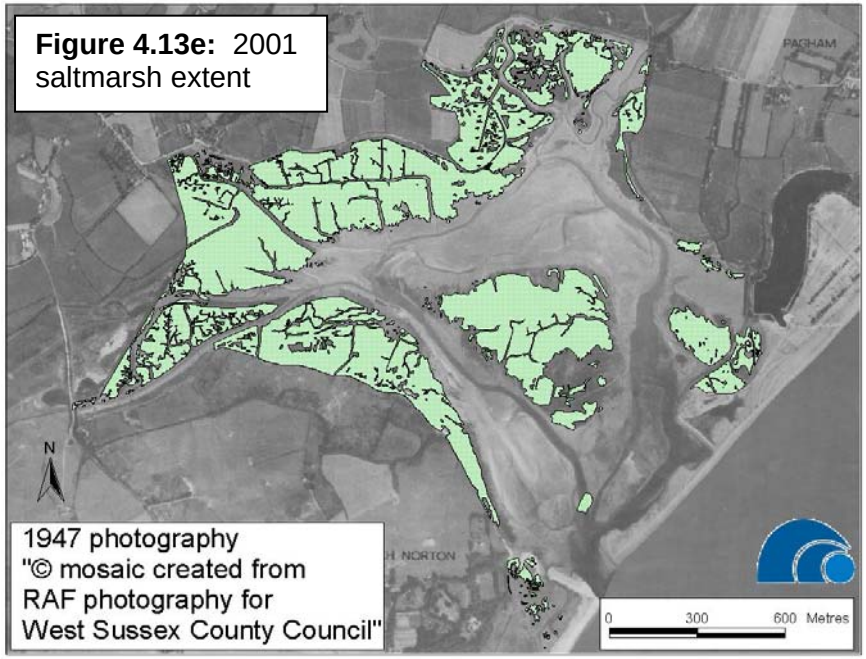


Figure 4.13e: 2001 saltmarsh extent

1947 -2001 (Figure 4.13f and Table 4.14)

The data shows that there is a net loss of 12.9% between 1947 and 2001, which equates to 0.2% per annum. The reason this rate of loss is so low compared with other areas in the north Solent is because this includes a gain of 8 ha between 1971 and 2001. The centre of Pagham Harbour shows the greatest loss of saltmarsh but there are also areas of erosion along the eastern side of the harbour and the northern landward edge. Saltmarsh gain occurred predominantly in the west of the harbour, with the greatest increase in saltmarsh on the northern seaward edge.

1947-1965 (Figure 4.13g and Table 4.14)

Between 1947 and 1965 there is an 18% net decrease in saltmarsh which equates to 1% per annum. This is the highest rate of loss experienced in the harbour. This decline has mostly occurred along the south-western, northern and western edges of the harbour eroding inland. A proportion of this loss may be attributed to no saltmarsh annuals present in the March 1965 photography. The photography is too early in the year to detect these. However, given the 1971 CHaMP extent (not shown), there is certainly a decline for this epoch. There are only small areas of saltmarsh gain, concentrated mainly in the south west of the harbour, showing saltmarsh moving inland.

1965 -1991 (Figure 4.13h and Table 4.14)

This epoch shows the greatest amount of change in saltmarsh area with a net gain of 1 ha which results in -0.1% loss per annum. Overall between 1965 and 1991 the total saltmarsh area has increased slightly, with the main accretions occurring in the west of the harbour. There is still some erosion within the centre and along the eastern edge of the harbour (Figure 4.13h). In contrast to the previous epoch, the saltmarsh along the south western edge of the harbour is re-colonizing towards the centre of the harbour, whilst the saltmarsh at the northern edge is accreting inland. However, as already mentioned, any apparent re-colonization maybe attributed to no saltmarsh annuals present in the March 1965 photography.

1991 -2001 (Figure 4.13i and Table 4.14)

The last decade of data shows the greatest area of stability (Figure 4.13i). Overall there is a net increase in saltmarsh of -0.5% per annum, occurring mainly in the centre of the harbour and also in the north-east corner of the harbour.

It is interesting to note that Pagham Harbour is an exception to the rule compared with saltmarsh loss throughout the rest of the north Solent, in that saltmarsh has been re-colonizing since 1971 (CHaMP data). It would appear that *Spartina anglica* and *Salicornia* are colonizing areas where *Halimione* was once established (CHaMPs, 2003). The pioneer system is therefore attempting to migrate landwards. Reasons for this require further investigation, but maybe due to a high sediment yield compared to other areas in the north Solent.

The following Figures 4.13f– 4.13i show the spatial change in coverage between 1947 – 2001, 1947 – 1965, 1965 – 1991 and 1991 – 2001 in Pagham Harbour.

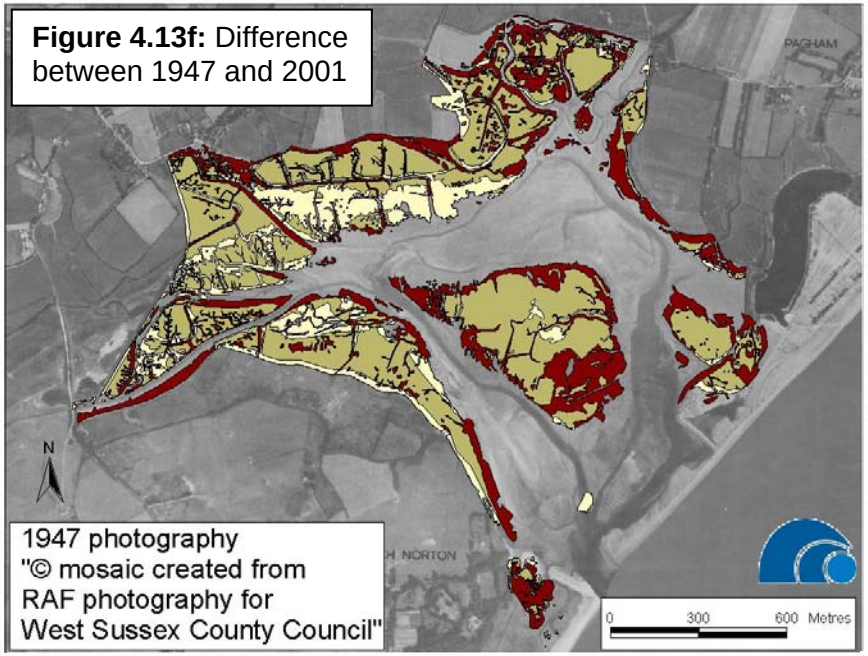


Figure 4.13f: Difference between 1947 and 2001

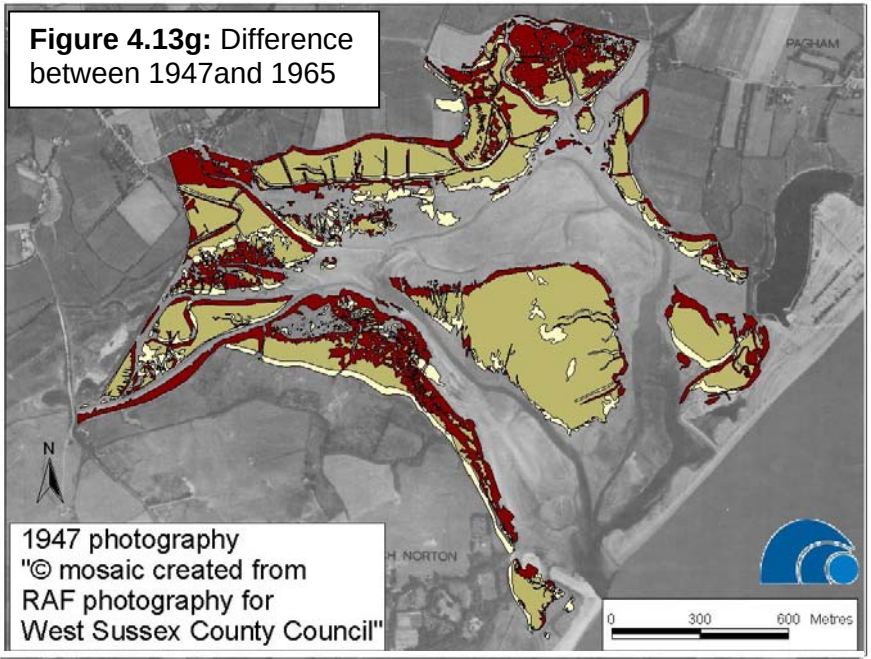


Figure 4.13g: Difference between 1947and 1965

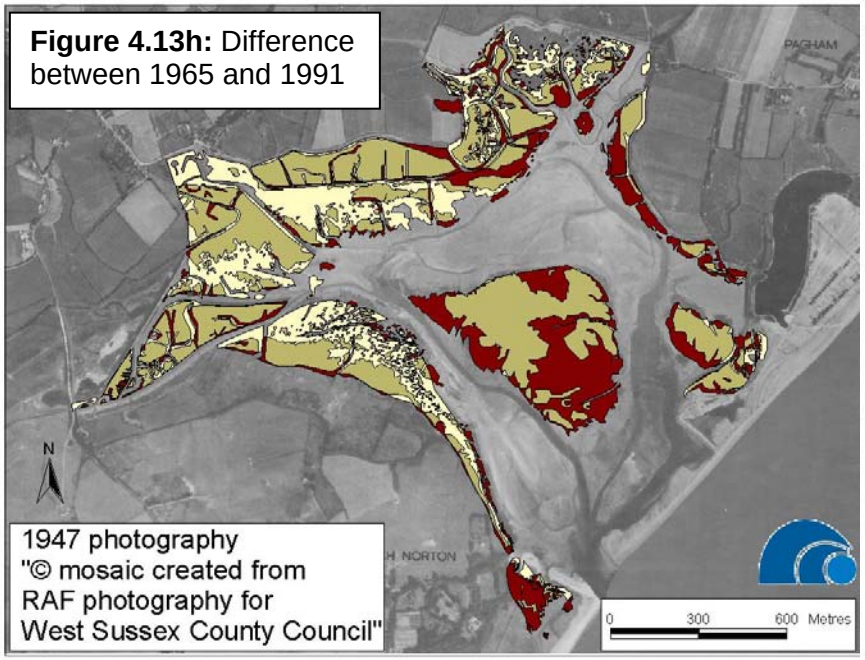


Figure 4.13h: Difference between 1965 and 1991

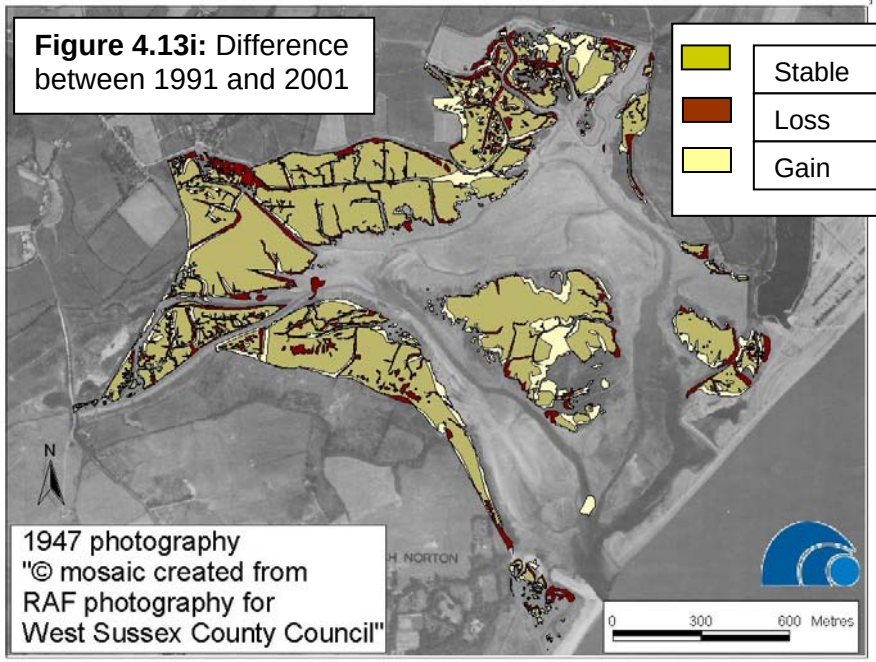


Figure 4.13i: Difference between 1991 and 2001

4.2.12.2 Predicted inter-tidal change

The following Figure 4.13j shows the area selected for LTEI calculations at Pagham Harbour for comparison with the HPI.

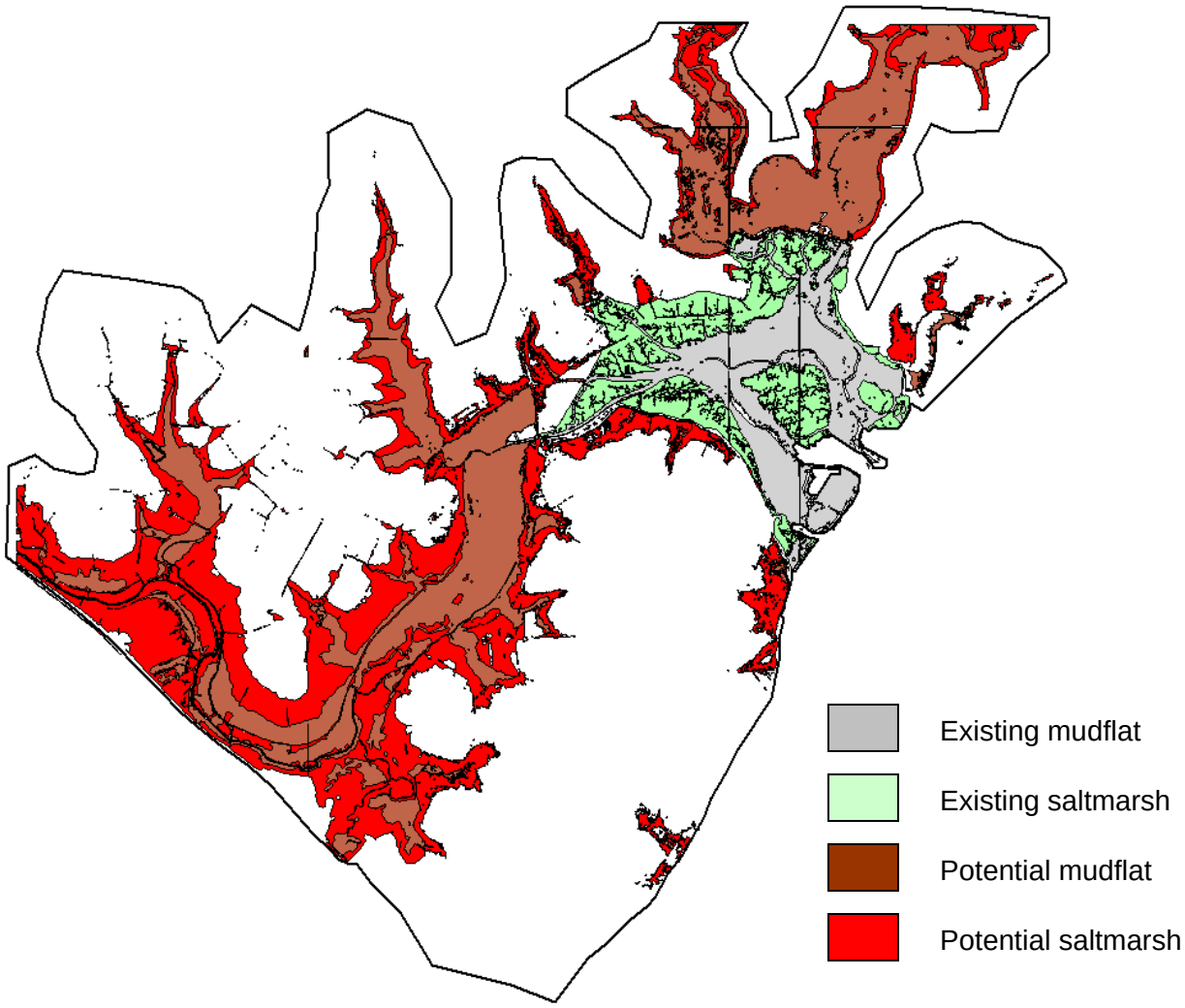
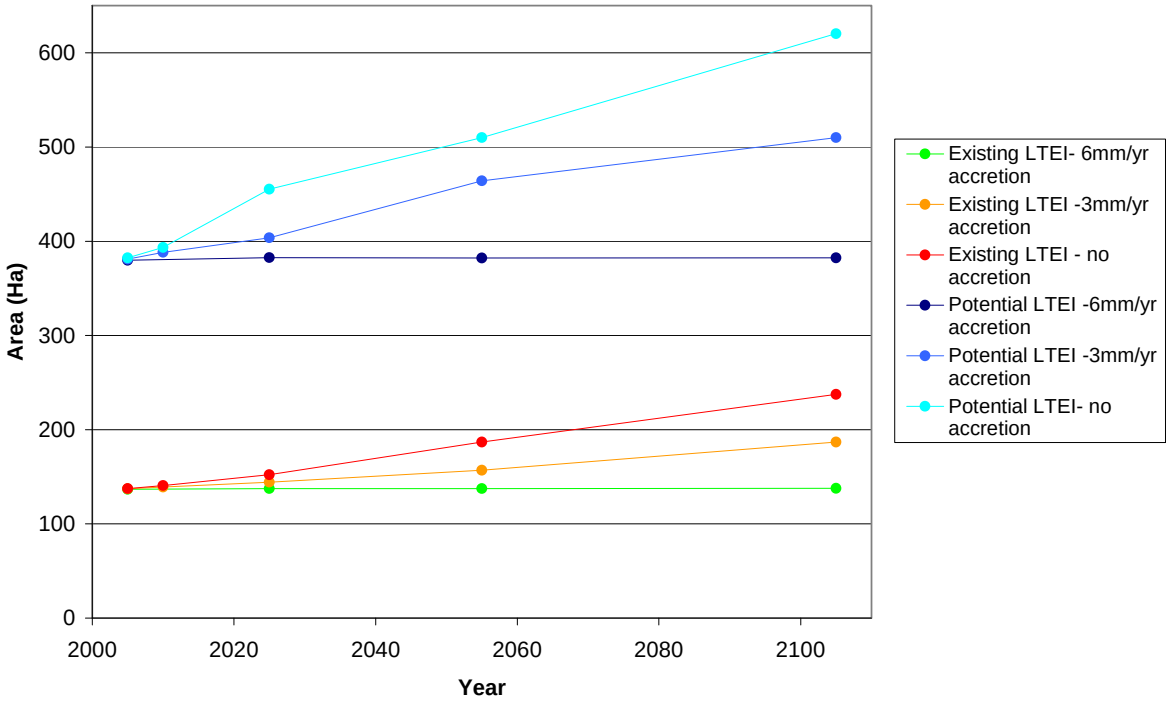
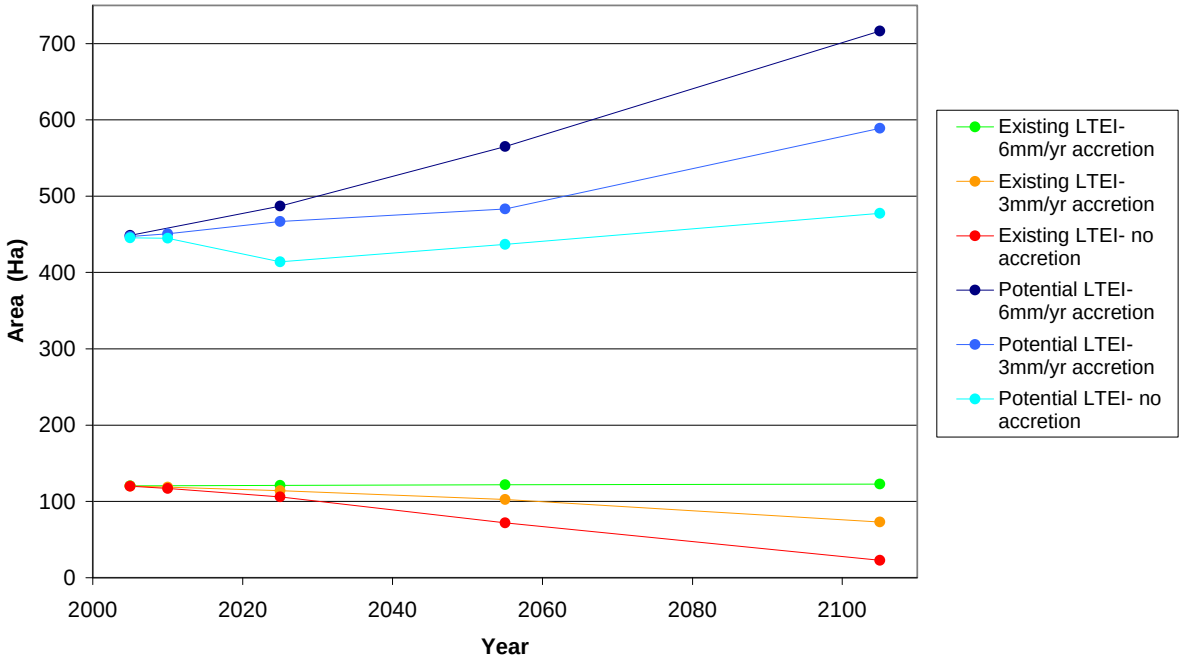


Figure 4.13j: Area selected for LTEI calculations at Pagham Harbour

Projected changes are presented for the "existing" management scenario (seawards of the seawall) and for "potential" increases in habitat areas arising from re-alignment (landwards of the seawall). Results are presented for mudflat (Graph 4.1b) and saltmarsh (Graph 4.1c), for the situation now, 5, 20, 50 and 100 years time for the no sediment accretion, 3mm and 6mm sediment accretion per annum LTEI scenarios.



Graph 4.12b: "Existing" and "potential" predicted mudflat extent in Pagham Harbour (based on LTEI)



Graph 4.12c: "Existing" and "potential" predicted saltmarsh extent in Pagham Harbour (based on LTEI)

Results show mudflat evolution under the existing management regime slightly increase through time as saltmarsh slightly decreases (Graph 4.12b and 4.12c respectively). There is approximately four times the amount of existing inter-tidal area available behind the sea defences in the event of re-alignment.

4.3 Historical saltmarsh change summary

Figures 4.13a and 4.13b summarise the historical saltmarsh extent derived from the HPI for the geographical units in the west and east Solent, respectively.

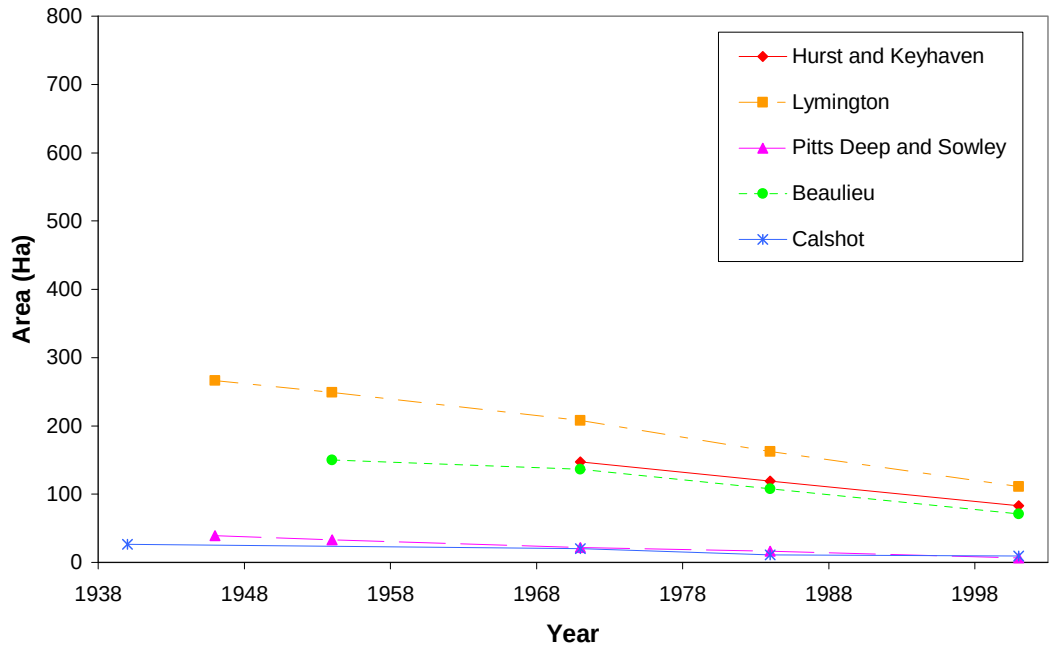


Figure 4.13a: Historical change in saltmarsh extent; west Solent (HPI)

A broadly linear trend of saltmarsh loss is experienced at all sites in the west Solent (Figure 4.13a). The rate of loss does not appear to be slowing down. This has worrying implications from an environmental and sea defence point of view.

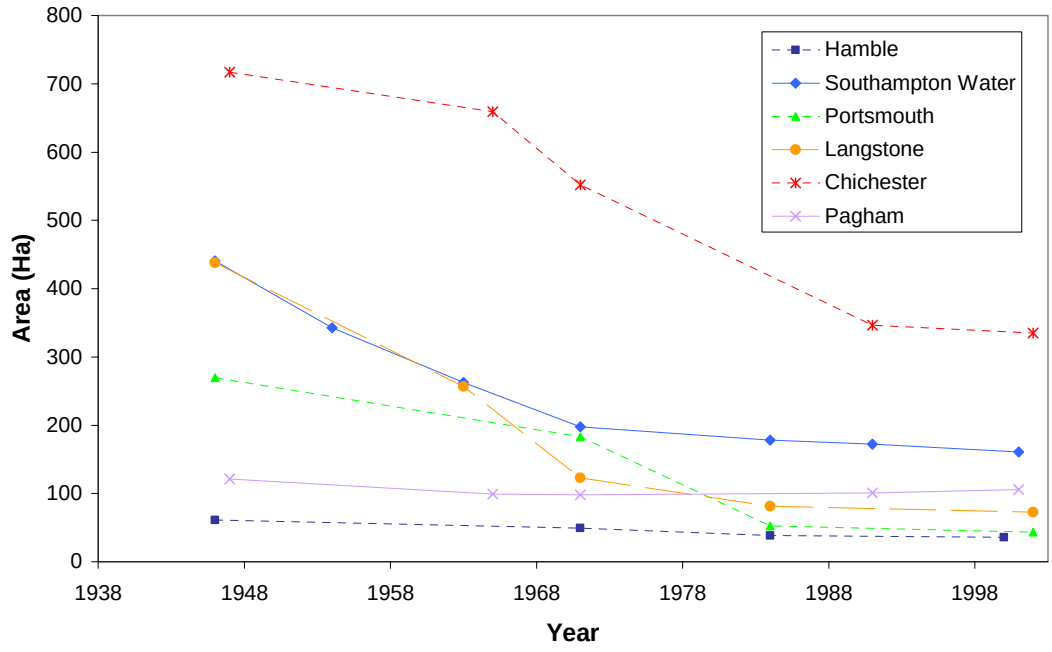


Figure 4.13b: Historical change in saltmarsh extent; east Solent (HPI)

The area of loss in the east Solent, excluding the River Hamble and Pagham Harbour, have historically been much higher than those in the west Solent but appear to be slowing down since ~1984 (Figure 4.13b). Future monitoring is required to confirm this. Pagham Harbour is an exception to all geographical units in the north Solent, since it underwent a net loss of 12.9% between 1946 – 2001, but the saltmarsh area has been increasing from 1971.

The greatest percentage of saltmarsh lost across the north Solent since the first date analysed was at Pitts Deep/Sowley and Portsmouth and Langstone Harbours. These areas underwent approximately 83% loss since 1946, which averaged 1.5% loss per annum. It should be noted that data for Portsmouth Harbour suggests the greatest loss since 1946, but the tidal elevation in the 1946 aerial photography limited the saltmarsh exposure for digitizing. In terms of the “worst bi-decadal period”, Portsmouth Harbour suffered 4.8% annual loss between 1971 - 1984, whilst Pitts Deep/Sowley and Calshot underwent 3.5% annual loss between 1984 - 2001 and 1971 - 1984 respectively.

The west Solent experienced high saltmarsh losses because of exposure to wave attack and *Spartina* dieback, which caused severe edge erosion. Further analysis revealed that both edge erosion and internal dissection were the important processes causing saltmarsh loss in Portsmouth and Langstone harbours. The extent of edge erosion is surprising given the sheltered nature of the harbours, but the local fetch has increased as the saltmarshes have eroded. In addition, the location of the hybrid cordgrass (*Spartina anglica),* which suffered dieback in the harbours since circa 1950, low in the tidal frame also played a role. All of these factors contributed to saltmarsh loss since 1946.

One major factor resulting in saltmarsh loss, not considered above, was reclamation of inter-tidal areas. Between 1940 and 2002 reclamation accounted for 1% of the saltmarsh losses at Langstone and Chichester Harbour, 8% at Portsmouth Harbour, 2% at Pagham Harbour, 24% at Calshot, 42% at Southampton Water and 18% at the River Hamble. The overall saltmarsh loss across the north Solent, from the earliest photography available (Table 3.2) was 1651 ha. 235 ha (14%) can be attributed to reclamation since the 1940’s (Figure 4.14).

4.4 Predicted future inter-tidal change

The following predictions were based on interpretation of tidal elevations and topography. Results may therefore represent an under-prediction of inter-tidal loss because the LiDAR and tidal elevation interpretation does not take account of local factors such as wave attack, *Spartina* dieback, pollution and dredging which increase mudflat and saltmarsh erosion.

The total predicted inter-tidal change for the north Solent, regardless of sea defences or environmental designations, was an increase of 60 hectares (ha) for mudflat (+1%) and a loss of 812 ha for saltmarsh (75%). This totals 752 ha inter-tidal loss over the next 100 years (11%). The SDCP saltmarsh results matched relatively well with the Solent CHaMP (2003), which predicted 736 ha of saltmarsh loss over the next 100 years. The mudflat prediction did not correlate so well with the CHaMP (2003) (+103-179 ha), because of differing methodologies and the fact that the LiDAR data used in the SDCP did not always reach mudflat depth (MLWS).

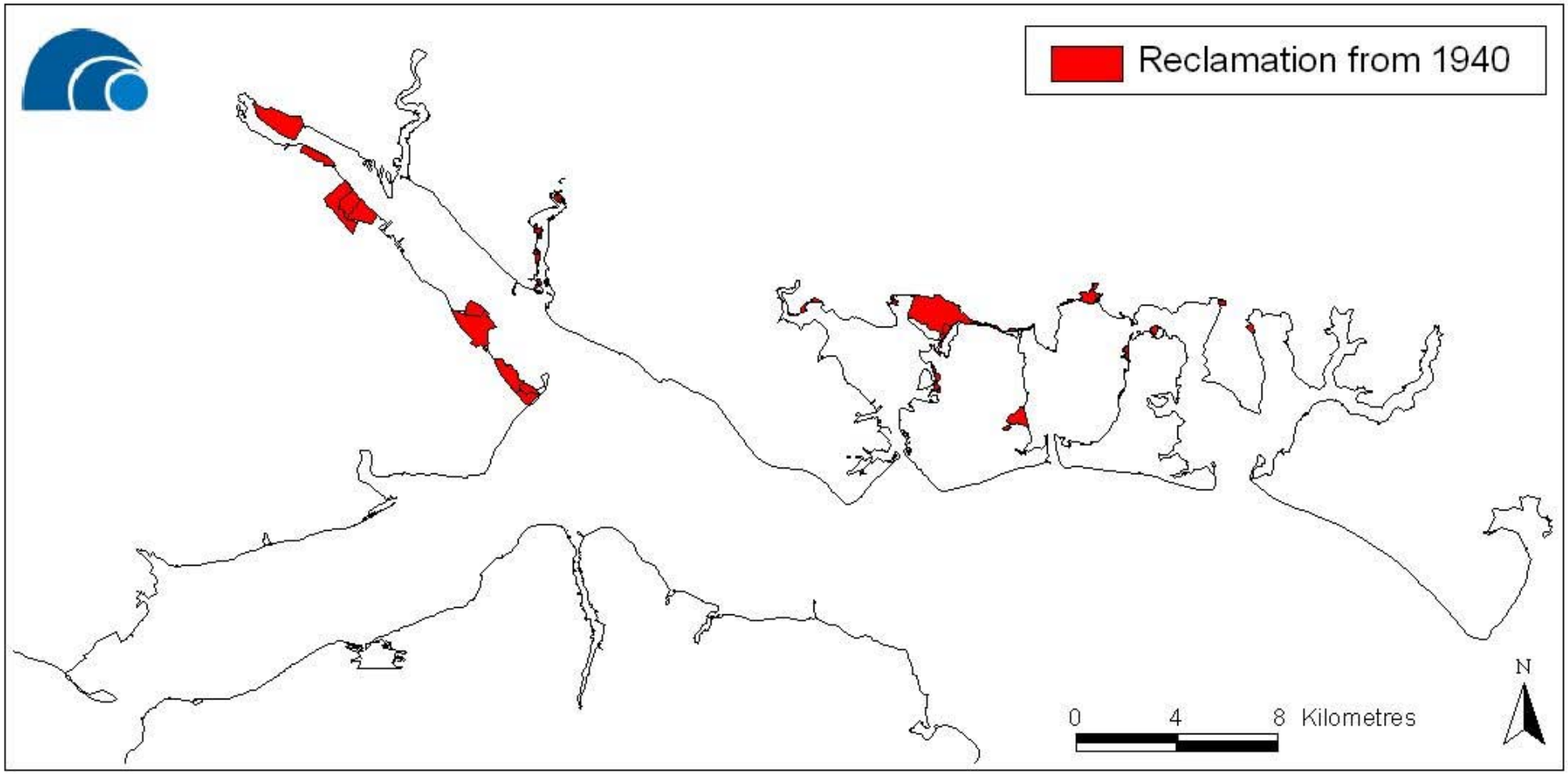


Figure 4.14: Reclamation across the north Solent from 1940

4.5 Predicted future inter-tidal coastal squeeze

Requirements for replacement inter-tidal habitat as a result of coastal squeeze across the north Solent were calculated, for sites where there was a sea defence or landfill inhibiting rollback of inter-tidal habitat. All inter-tidal habitats in the north Solent are designated Natura 2000 sites. In order to estimate the maximum amount of replacement inter-tidal habitat required to mitigate/compensate for coastal squeeze, it was assumed that existing defences (causing coastal squeeze) and designations will be maintained over the next 100 years. This resulted in an estimation of approximately 5 ha of mudflat loss due to coastal squeeze (0.1%) and 495 - 595 ha of saltmarsh loss due to coastal squeeze (45 – 55%) requiring replacement across the north Solent. In reality not all defences will be maintained (see Section 5), hence this total estimate of 500 – 600 ha of inter-tidal coastal squeeze (8 – 9%) provides a worst case scenario.

5 Potential inter-tidal habitat creation sites

This section examines the viability of potential inter-tidal habitat creation sites based on those identified in the GIS analysis. Two approaches were undertaken;

- use of the GIS to “knock sites out” so that those requiring further investigation could be identified and
- use of a questionnaire and matrix to rank the sites into time epochs

The GIS findings were undertaken on a Solent wide scale.

5.1 GIS

Approximately 3883 ha, within 100 individual sites, were identified as being capable of creating mudflat or saltmarsh over the next 100 years. These results were obtained from LiDAR and tidal elevation interpretation, assuming natural evolution over a 100 year period. Figure 5.1 shows the situation now (3214 ha).

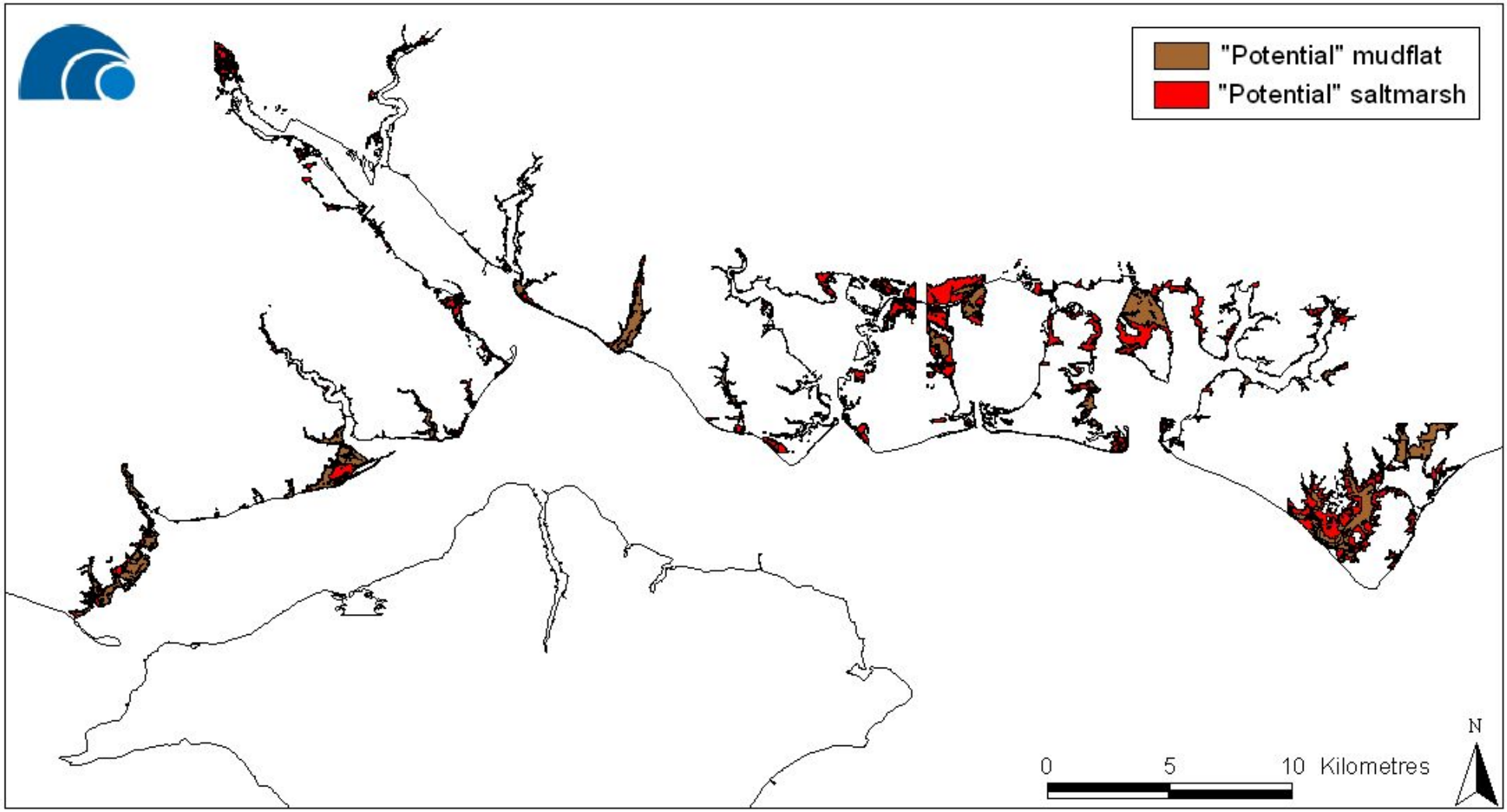


Figure 5.1: Potential inter-tidal habitat creation sites under natural evolution

Figure 5.2 presents those factors which impede managed re-alignment and were readily available as GIS layers. Each GIS layer was removed from the original shapefile shown in Figure 5.1, in a cumulative manner, to identify key sites that could be analysed in more detail.

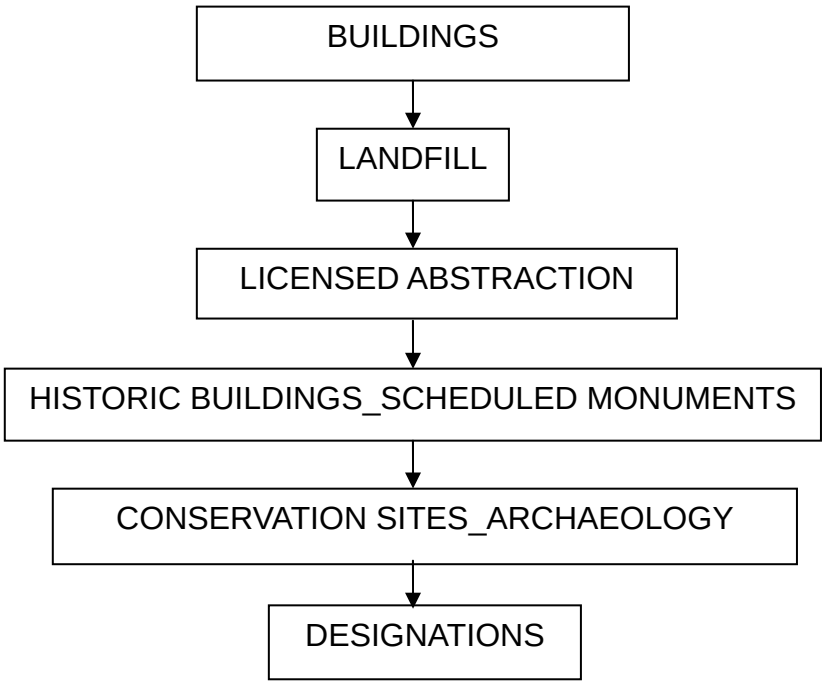


Figure 5.2: Main factors considered to impede re-alignment once a site has been identified as suitable for mudflat and saltmarsh creation.

- Buildings

Any buildings, whether residential or commercial were removed from the baseline (Figure 5.1). The majority of gardens were also removed, although on big estates it was difficult to distinguish between a garden and a field. Golf courses and caravan parks were also removed. As these facilities can be re-located, unlike fixed housing, a separate shapefile was digitized which highlights where these overlap with potential habitat creation sites.

- Landfill

Re-alignment is virtually impossible on landfill sites, unless the landfill is relocated. There is the potential to do this but at a colossal cost. In the majority of cases this is not cost beneficial in the short term but in the longer term may become more financially viable as the cost of maintaining the existing sea defence increases. For this study, landfill sites were not considered to be viable as inter-tidal habitat creation sites and therefore all existing and former landfill sites were removed.

- Licensed abstraction sites

Licensed abstraction sites pose a problem for managed re-alignment in that they require freshwater input. The EA licences water abstraction and as a result have some rights to maintain the fresh water supply. Re-alignment or Regulated Tidal Exchange (RTE) could compromise these extractions. The Agency would have to negotiate a revocation of these licenses and provide compensation if abstraction sites become contaminated.

- Historic buildings and scheduled monuments

Listed buildings are designated under the *Town and Country Planning Act 1990*. English Heritage (2003) state that, "Any works to listed buildings may require *Listed Building Consent*." Scheduled Monuments are designated under the *Ancient Monuments and Archaeological Areas Act 1979* (English Heritage, 2003). Any works impacting on Scheduled Monuments require planning permission and specific permission from the Secretary of State for Culture, Media and Sport (English Heritage, 2003).

- Conservation sites and archaeology

Conservation areas are also designated under the *Town and Country Planning Act 1990*. English Heritage (2003) state that, "The demolition of buildings within a conservation area may require *Conservation Area Consent*."

English Heritage (2003) advises that whether designated or not, archaeological sites are non-renewable. They should, wherever possible, be preserved and should not be needlessly or thoughtlessly destroyed. "Whilst there is no legal obligation to protect unscheduled sites, PPG 16 sets out best practice which should be followed.'

English Heritage (2003) state that, "Other historic sites, including historic parks and gardens and historic battlefield sites are included within non-statutory registers, which underline the need to consider their special importance within the planning process when development is proposed."

English Heritage (2006) does acknowledge that at some point a historical asset will be in the path of a "No active intervention" policy. English Heritage (2006) state that their, "initial advice is that significant historic assets should be protected by means of coastal defences wherever this is economically, technically and environmentally sustainable." Where this is not sustainable, provision should be made, "for additional studies to quantify the rate of resource loss, and to identify appropriate mitigation strategies. These might involve 'preservation by investigation' for archaeological sites (i.e. survey, excavation and recording) or recording, (followed controlled dismantling and/or relocation in some cases), for historic buildings."

- Environmental designations

Where possible, Natura 2000 coastal habitat should be protected in situ, where it is sustainable to do so. An Appropriate Assessment (AA) is required where a plan or project is likely to have a significant effect on a Natura 2000 site. Such impacts include coastal squeeze seaward of a seawall and habitat changes caused by flooding, landward of a seawall. Where it cannot be concluded that there will not be an adverse affect on the site, the scheme may only proceed if there are no alternative solutions, it has imperative reasons of overriding public interest and compensatory habitat is established and functioning before the damaging works start (DEFRA, 2005, DEFRA Circular, 2005).

The cumulative reduction in hectares, as each factor was removed, is presented in Table 5.1 and the final outcome is presented visually in Figure 5.3.

Factor type	Area (Ha)		
	Mudflat	Saltmarsh	Total
Baseline file	1525.9	1688.2	3214.1
Buildings	1187.4	1185.4	2372.8
Landfill	1107.7	1036.6	2144.3
Licensed abstraction	1100.2	1032.9	2133.1
Historic buildings_scheduled monuments	1098.4	1029.5	2127.9
Conservation sites_archaeology	1087.9	1005.0	2092.9
Designations	307.7	497.5	805.2

Table 5.1: Hectares of potential inter-tidal habitat creation as impeding factors were removed.

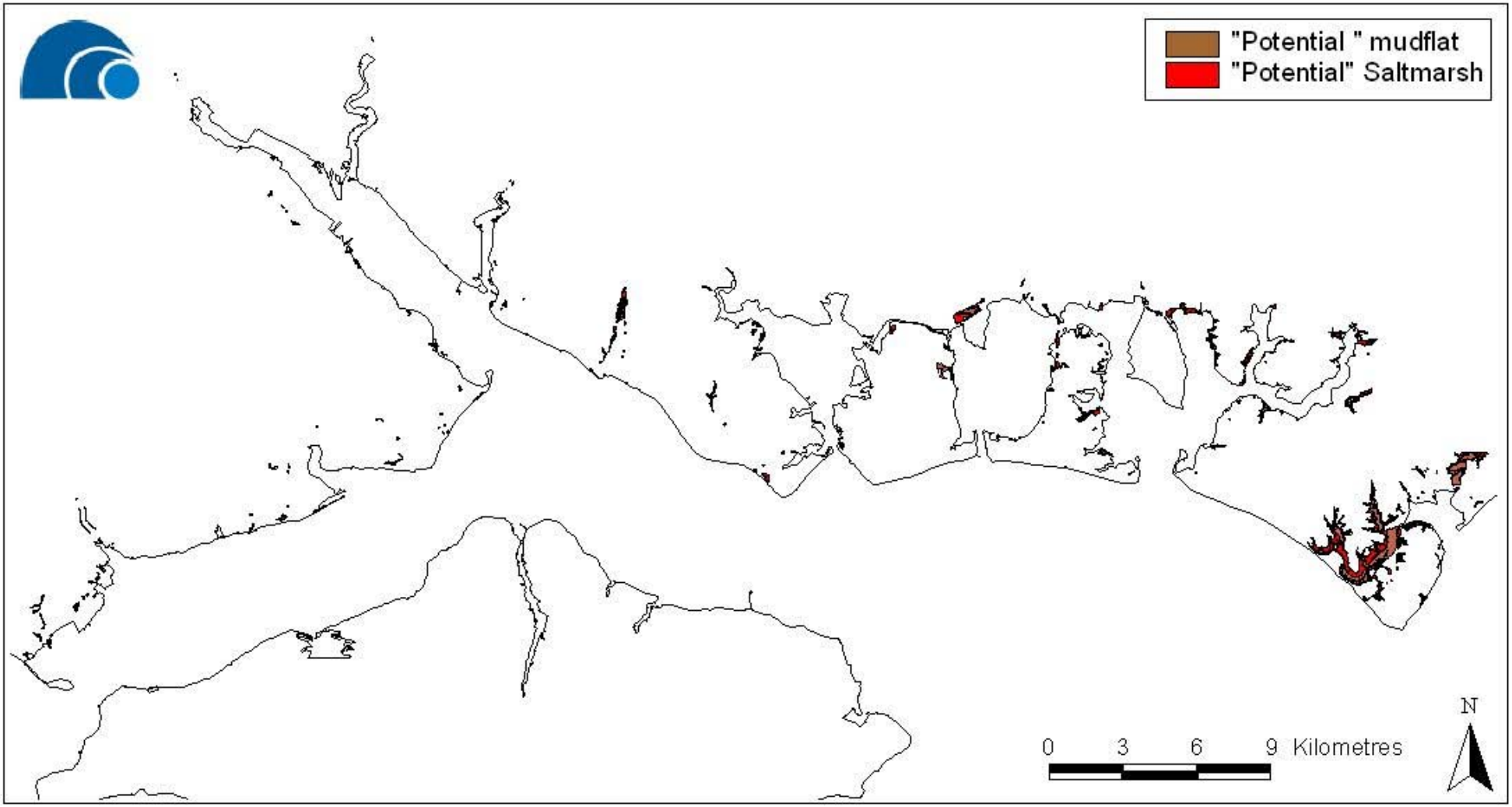


Figure 5.3: Everything plus environmental designations removed

The main factors affecting inter-tidal habitat creation on a north Solent wide basis are landfill and environmental designations (Table 5.1 and Figures 5.3 and 5.4). Landfill is a major barrier against managed re-alignment as any toxic material will need to be removed prior to re-alignment. This is extremely costly. Environmental designations, on the other hand, require assessment on a site by site basis. Where a designated freshwater site is also a potential inter-tidal habitat creation site, Natural England must clarify whether re-alignment will have an adverse effect and if so, whether compensatory freshwater habitat is required.

The sites that were identified for further assessment were West Northney, Stoke and Fleet in Langstone Harbour, Selsmore, Pounds Marsh, Prinstead, Nutboune, West Chidham_a, East Chidham_a and b, Fishbourne_a, Appledram, Birdham, Westlands and Ella Nore in Chichester Harbour, Medmerry and Pagham South around Pagham Harbour. This approach did not consider other key factors such as, land ownership, rights of way, residual life of defences, benefit-cost of re-alignment and crucially, Natural England's advice on how to manage the effects of re-alignment over European sites. Consequently, the questionnaire was devised.

5.2 Questionnaire

Local coastal managers (Local Authority (LA) or EA) were interviewed using a questionnaire (see Appendix 2), devised by the EA, NE and CCO, which sought to assign the potential 54 sites into time epochs where they were eligible for re-alignment or abandonment. Where they were not eligible for either, they were categorised as hold the line. During the questionnaire process it was necessary to make a number of assumptions. All assumptions affect the spatial and temporal pattern of potential inter-tidal habitat creation sites presented at the end of the study. Any of these assumptions can be changed in later work for SMP2 to give a different picture as required. No attempt was made to incorporate issues in relation to non-statutory bodies, land ownership and public opinion. The importance of these issues is not under-estimated and will need to be tackled when focusing on key habitat creation sites.

The 100 year scenario was used for the questionnaire. From the 3883 ha, buildings (more than five), landfill and sites under 0.5 ha were excluded, leaving 2025 ha remaining (54 sites) (Figure 5.4). These 54 sites went forward to the questionnaire stage.

5.2.1 Publicly maintained defences

The initial section of the questionnaire was based on DEFRA approved economic assessment (see Appendix 2). Information was gathered on built assets and the lengths of existing flood defences. Secondary defences were proposed for those sites where re-alignment would cause potential flood risk to five or more buildings/landfill. Coastal managers assessed whether the current line of defence or any re-aligned defence would meet DEFRA 'benefit-cost' rules, potentially enabling an operating authority (OA) to bid for funds to defend. The cost of continuing to 'hold the line' was compared with the cost of re-aligning defences back.

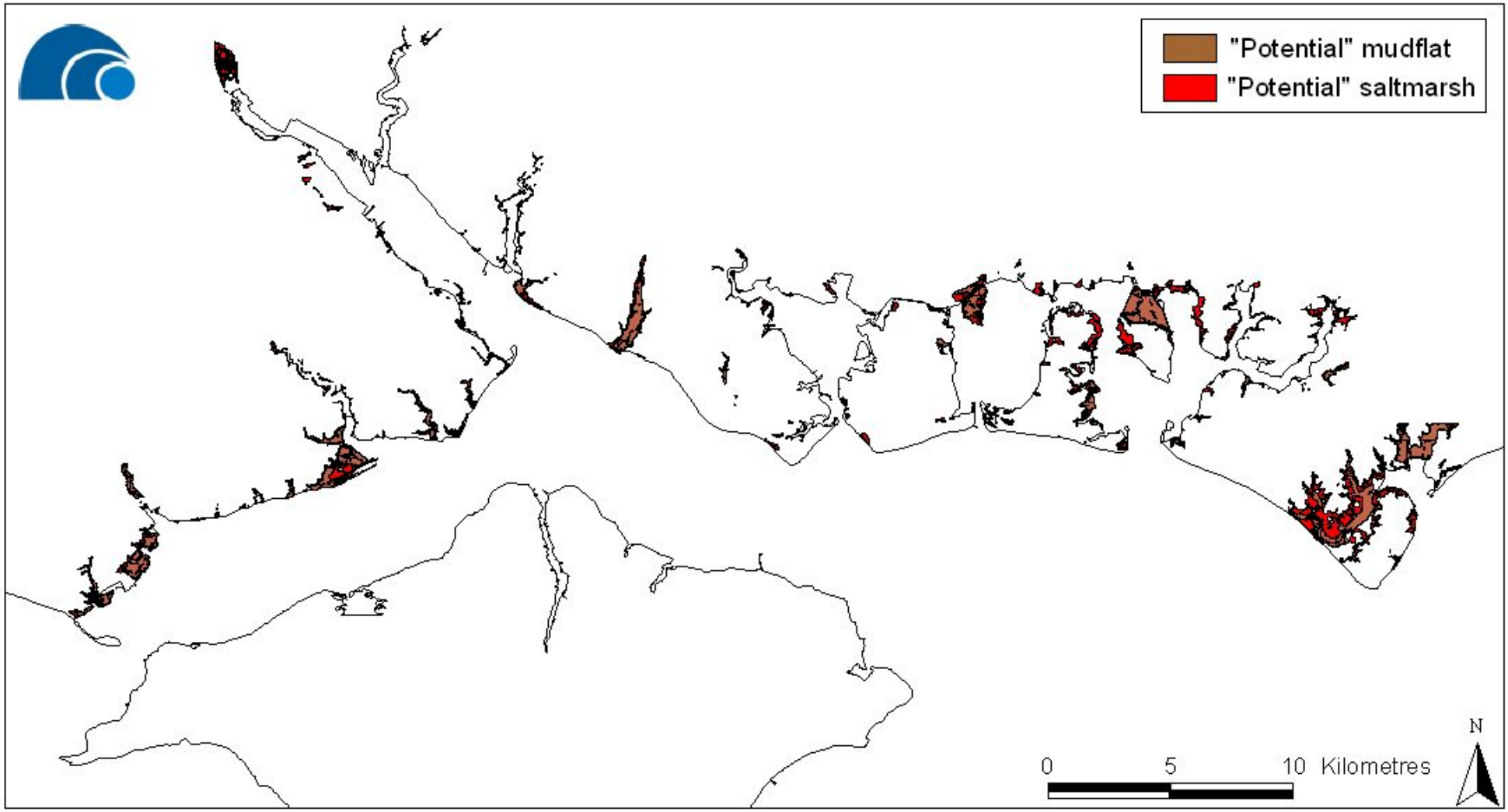


Figure 5.4: Potential inter-tidal habitat creation sites in 100 years, under natural evolution with buildings and landfill removed

- Where there was an adequate benefit-cost but it was more expensive to re-align than to hold the existing line, the site was categorised as ***hold the line*** at present.

- Where there was insufficient benefit-cost on the existing or re-aligned route, the site was classified as ***abandonment***.

- Where the benefit-cost of the re-aligned route was better or the same as holding the existing line, ***re-alignment*** or ***regulated tidal exchange (RTE)*** through a tidal flap was recommended.

5.2.2 Privately maintained defences

During the course of the study it was found that around two thirds of defences in front of potential inter-tidal habitat creation sites are in private ownership and management. The extent of private ownership in the Solent has not previously been recognised by national experts devising policies and approaches to coastal management; this study helped to raise the profile of this important issue. It should be noted that defences maintained by Hampshire County Council and the Ministry of Defence were categorised as publicly funded, rather than privately maintained.

Initial assumptions based on national guidance had to be made about the possible future of private defences in order to complete an initial draft picture for the north Solent. Any of these assumptions can be changed for future management plans.

It was assumed that private owners would wish to continue maintaining their defences on a like for like basis as long as this was practical and they obtained the necessary consents prior to works. Coastal managers advised when such defences were likely to come to the end of their residual life, when maintenance was no longer an option. The current study assumed that these privately owned defences would be abandoned since extensive privately funded capital works might be prohibitively expensive. The majority of privately maintained defences had insufficient benefit-cost. Still, where it is judged likely, the EA could seek to adopt the line of defence when capital works are required.

To summarise, potential re-alignment and abandonment sites were assigned to an SMP time epoch (0-19, 20-49, 50-100 and 100 years+) during which the current defence was judged to reach the end of its residual life and therefore fail.

5.2.3 Re-aligning over a designated freshwater SPA

Of the 54 potential sites being considered, 28 covering 1089 ha were designated as Natura 2000 sites and SSSI landwards of the sea wall. Such sites needed further consideration to ensure that any potential re-alignment or abandonment complied with the Habitat Regulations and other policy and procedures. Guidance on how to consider such sites has been provided in recent NE work (Burn and Collins, 2006).

DEFRA have advised that Natura 2000 sites should be defended ‘as long as it is sustainable to do so’. This study has only been able to consider how long it would be economically viable to defend a site. Where re-aligning defences landwards would involve a knock-on adverse effect on freshwater habitats then the cost of replacing those habitats was added into the cost of re-aligning.

The Table under Q.17 in the questionnaire (see Appendix 2) was drawn up to reflect current environmental guidance. It was used to re-consider which epoch a site could be assigned to for potential re-alignment or abandonment, and what the knock-on consequences were for the designated features of interest.

It was typically considered that designated sites were not 'sustainable' to defend beyond the residual life of the sea wall (Table Q.17, row 1). Where coastal managers judged that the residual life of publicly maintained defences could be extended cost-effectively (which would help conserve the existing freshwater designation) this was noted. It is important to note that the standard of defence required to maintain a freshwater habitat is usually much lower than that required to protect property.

The length of time that a given standard of defence would allow a site to continue to meet its conservation objectives, either as the same habitat type or a different habitat type, was then noted (Table Q.17, rows 2 and 3). Where the level of saline intrusion resulted in the site no longer meeting its conservation objectives it was judged that an 'adverse effect' would occur. At this time replacement habitat would be required to be present and fully functioning for an 'adverse effect' under the Habitat Regulations to be avoided (Table Q.17, row 4).

It takes time to create replacement freshwater habitat; for the most diverse sites this is assumed to be 50 yrs. Table Q.17, row 5 records when it would be necessary to begin the process of creating replacement habitat in order that it would be functioning in time to avoid an adverse effect through re-alignment or abandonment. Private owners would not be responsible for habitat changes to Natura 2000 sites as a result of cessation of maintenance of their own defences. However the amount of replacement freshwater habitat required was added to a total for the north Solent.

Although potential re-alignment and abandonment sites were scored according to environmental value, this score did not play a part in the selection of epoch. This is because there were over-riding technical and economic reasons that dictated when the sites would be re-aligned or abandoned, namely when the wall came to the end of its residual life.

5.2.4 The influence of abandonment

It was assumed that, where a defence is abandoned by an OA, the inter-tidal habitat created cannot be used as mitigation or compensation to offset a damaging scheme. This was because there is no active intervention to 'secure' the new habitat and there is little certainty when the new habitat might be established. Similarly, it was assumed that sites with defences in private ownership could not be used by operating authorities to offset squeeze.

It is important to note that recent national guidance has suggested that in the future, inter-tidal habitat created through abandonment could help to mitigate or compensate for coastal squeeze under the Habitat Regulations. However, this study did not account for this.

5.3 Questionnaire results

The location and potential management option for each of the 54 potential inter-tidal habitat creation sites are presented. The following figures present the overall location and management option for each site; the constraints to re-alignment identified within the GIS analysis and the possible secondary defences required to prevent flooding to assets. These all helped to inform the questionnaire and site ranking (Section 5.4). The definitions for each management options are explained in Table 5.2 and are represented in the first figure for each area.

Definition	Explanation
Re-align	Equal or better benefit-cost to re-align than hold the line
Abandon_OA	Inadequate benefit-cost to hold the line or re-align
Abandon_private	
Hold the line	Better benefit-cost to hold the line than to re-align
Natural	No defence present so naturally occurring
Factored out	Either landfill, site under 0.5 ha or not feasible for socio-economic reasons (i.e. – major road)

Table 5.2: Explanation of definitions used

5.3.1 Hurst Spit and 3.2.2 Keyhaven

Potential habitat creation sites (Figure 5.5a), GIS constraints (Figure 5.5b) and requirement for secondary defences (Figure 5.5c) within the Hurst Spit and Keyhaven geographical units are presented.

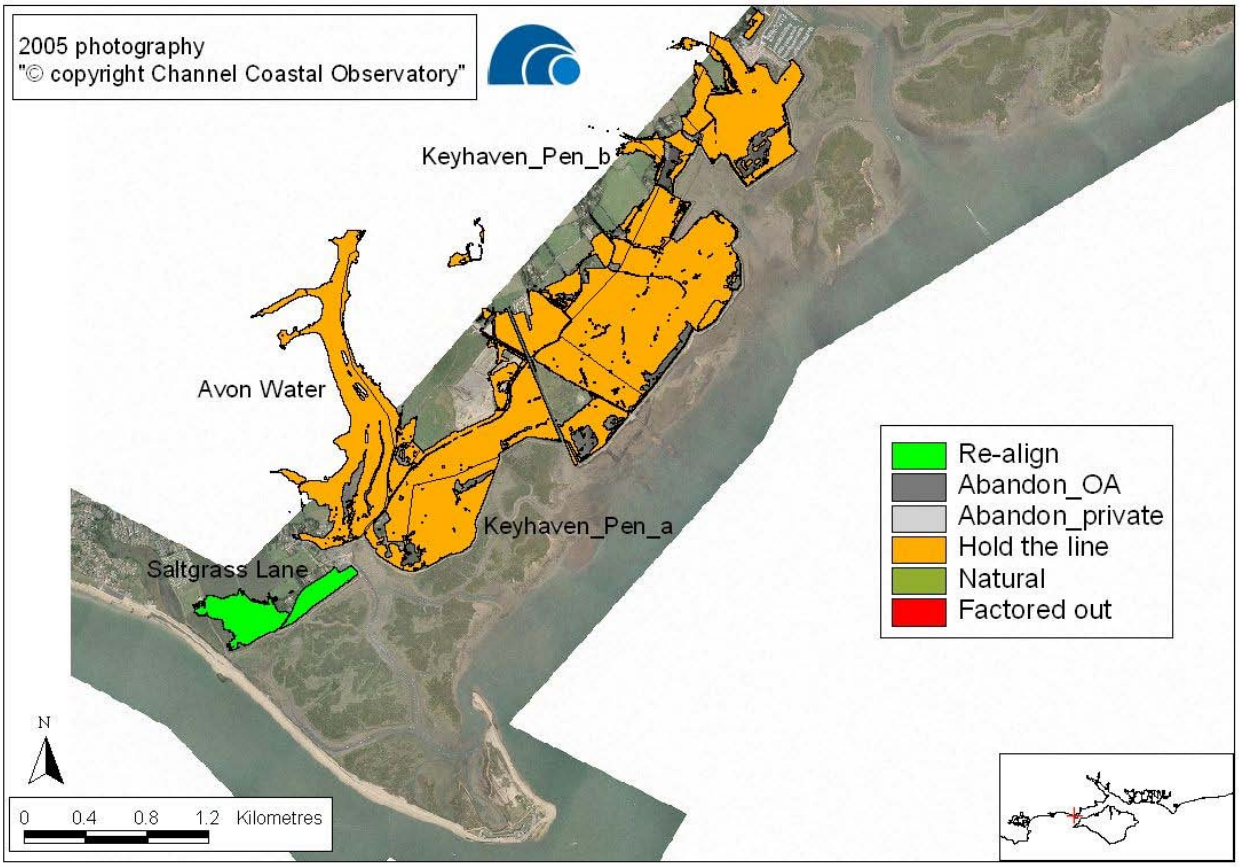


Figure 5.5a: Potential habitat creation sites

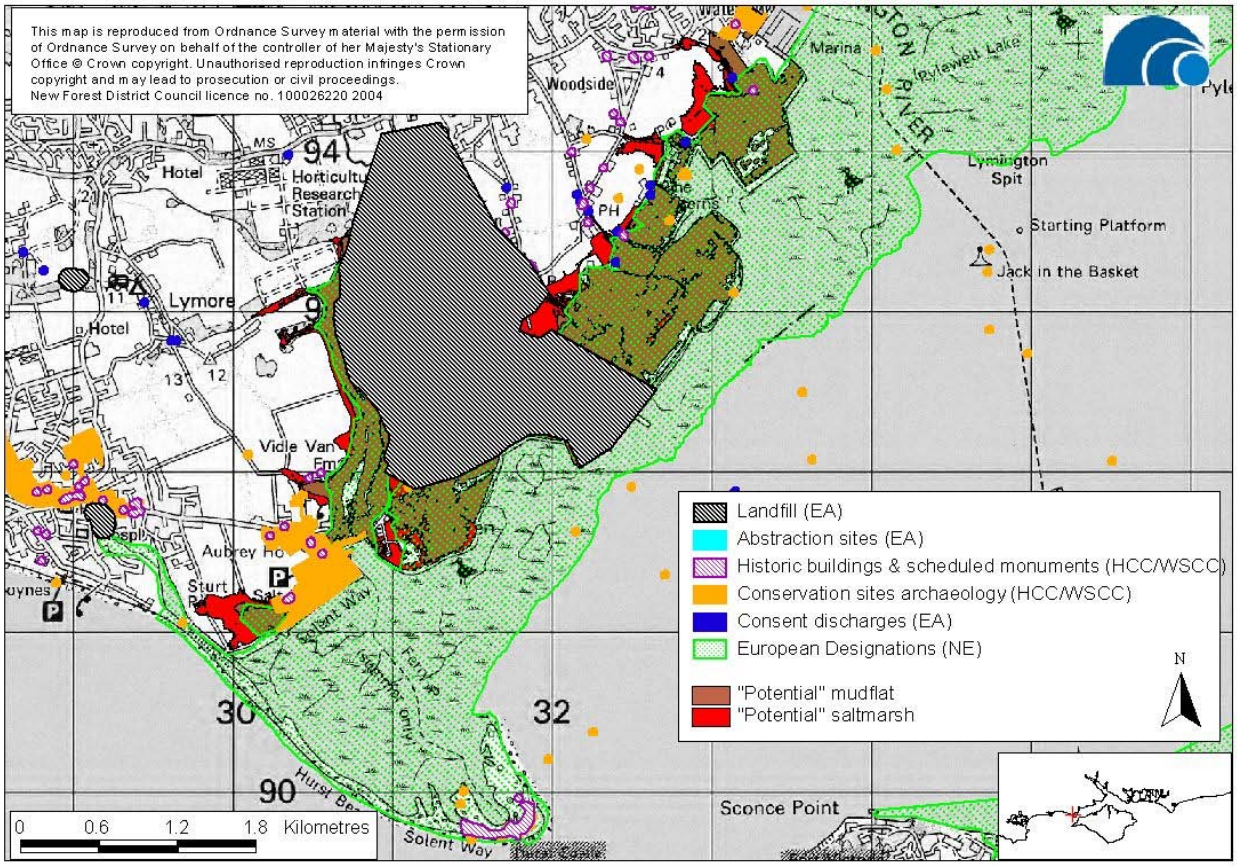


Figure 5.5b: Managed re-alignment constraints available as GIS layers

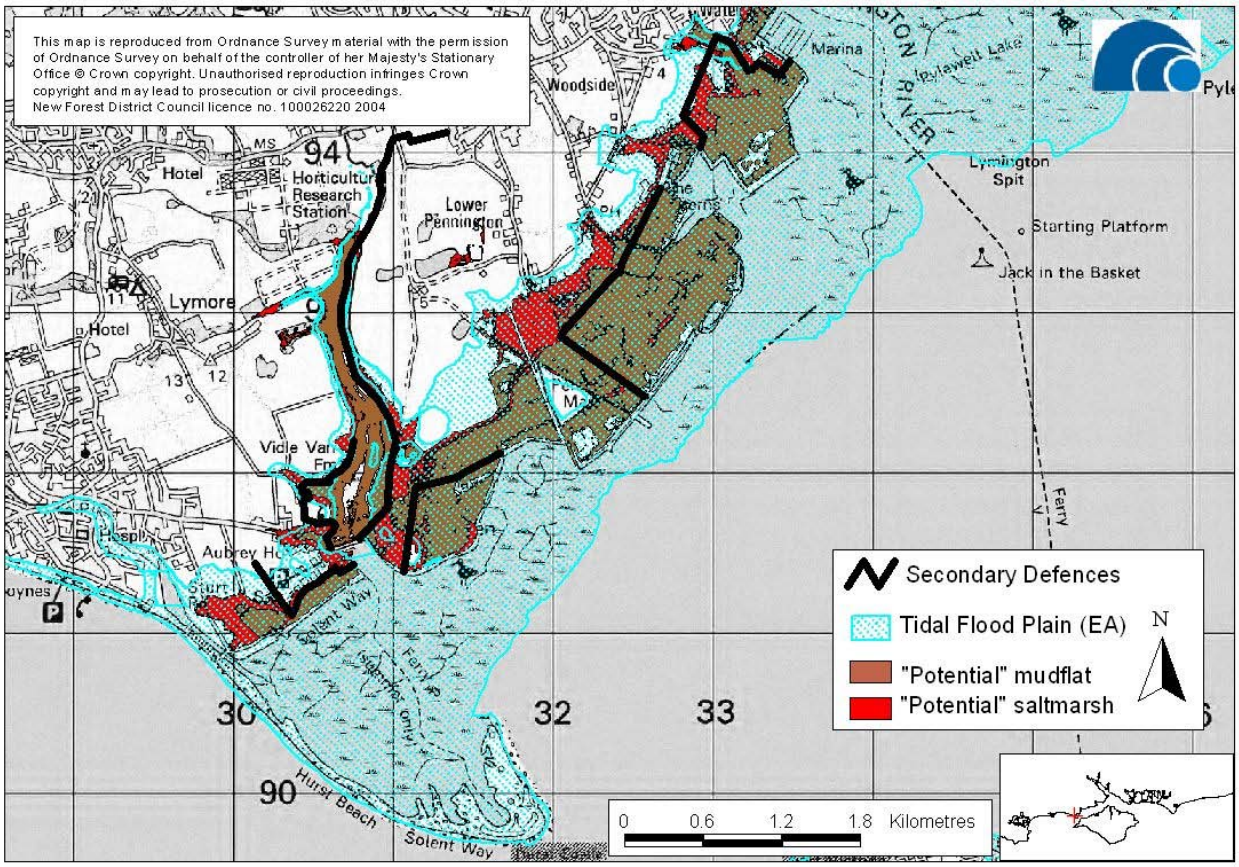


Figure 5.5c: Secondary defences required to protect development from tidal flooding.

The defence at **Saltgrass Lane** (Figure 5.5a) is maintained by the EA. The site is recommended for **re-alignment** and RTE in epoch 0-19 at the end of the existing defence residual life, as there appears to be better benefit cost on the re-aligned route (973 m) compared to the existing defence (1133 m). The site has the potential to create 10 ha of inter-tidal habitat if re-aligned now and 16 ha of inter-tidal habitat in 100 years time. Approximately 5 ha of the site is designated as a SPA and is grazing marsh. This will require compensation starting **now** if the 5 ha is to be used as mitigation to offset inter-tidal coastal squeeze from future damaging schemes within the Solent and Southampton Water SPA. The remaining 11 ha may be used as compensation. The cost of creating replacement freshwater habitat could tip the balance and make it cheaper to hold the existing line rather than re-align at the site.

The sluice at the **Avon Water** (Figure 5.5a) is maintained by the EA. The site is recommended for **hold the line** as there is better benefit-cost on the existing route (205 m) compared with the potential re-alignment route (4243 m). The reason for the extreme secondary defence length is to protect Efford landfill site situated to the east (Figure 3.7). RTE would be the only sensible option, rather than full re-alignment because the site is an old river valley. A secondary defence may still be required. The site has the potential to create 41 ha of inter-tidal habitat and 36 ha of inter-tidal habitat in 100 years time under full re-alignment. Under RTE there would be less habitat created. The site is designated as a SPA and would not require replacement habitat if RTE took place.

The defence at **Keyhaven_Pennington_a** (Keyhaven_Pen_a in Figure 5.5a) is maintained by the EA. The site is recommended for **hold the line** as the existing defence (1400 m) and potential re-alignment route (1102 m) are similar in length and once the need for replacement saline lagoon and grazing marsh habitat (designated for SPA) is factored into the scheme cost, there is likely to be better benefit cost on the existing route (1400 m). The site has the potential to create 24 ha of inter-tidal habitat if re-aligned now and 24 ha of inter-tidal habitat in 100 years time if the secondary defence depicted in Figure 3.8 was to be built. The site is designated as a SPA and would require replacement habitat if re-alignment took place.

The defence at **Keyhaven_Pennington_b** (Keyhaven_Pen_b in Figure 5.5a) is maintained by the EA. The site is recommended for **hold the line** even though there is better benefit-cost on the potential re-alignment route (2500 m) compared with the existing line of defence (4000 m). This is because once the need for 100 ha replacement saline lagoon and grazing marsh habitat (SPA) is factored into the scheme cost, it is thought that a better benefit cost will remain on the existing route (4000 m). In addition, “EA’s withdrawal of maintenance from sea defences policy” states that defences that are required to protect internationally designated environmental features from the damaging effect of flooding will continue to be maintained in the short term. The site was categorised as having adequate benefit-cost because of the need to protect the Efford landfill site situated to the west. It is questionable whether the eastern section of the site, next to the marina would meet benefit-cost requirements.

5.3.3 Lymington and 3.2.4 Pitts Deep and Sowley

Potential habitat creation sites (Figure 5.6a), GIS constraints (Figure 5.6b) and requirement for secondary defences (Figure 5.6c) within the Lymington and Pitts Deep/Sowley geographical units are presented.

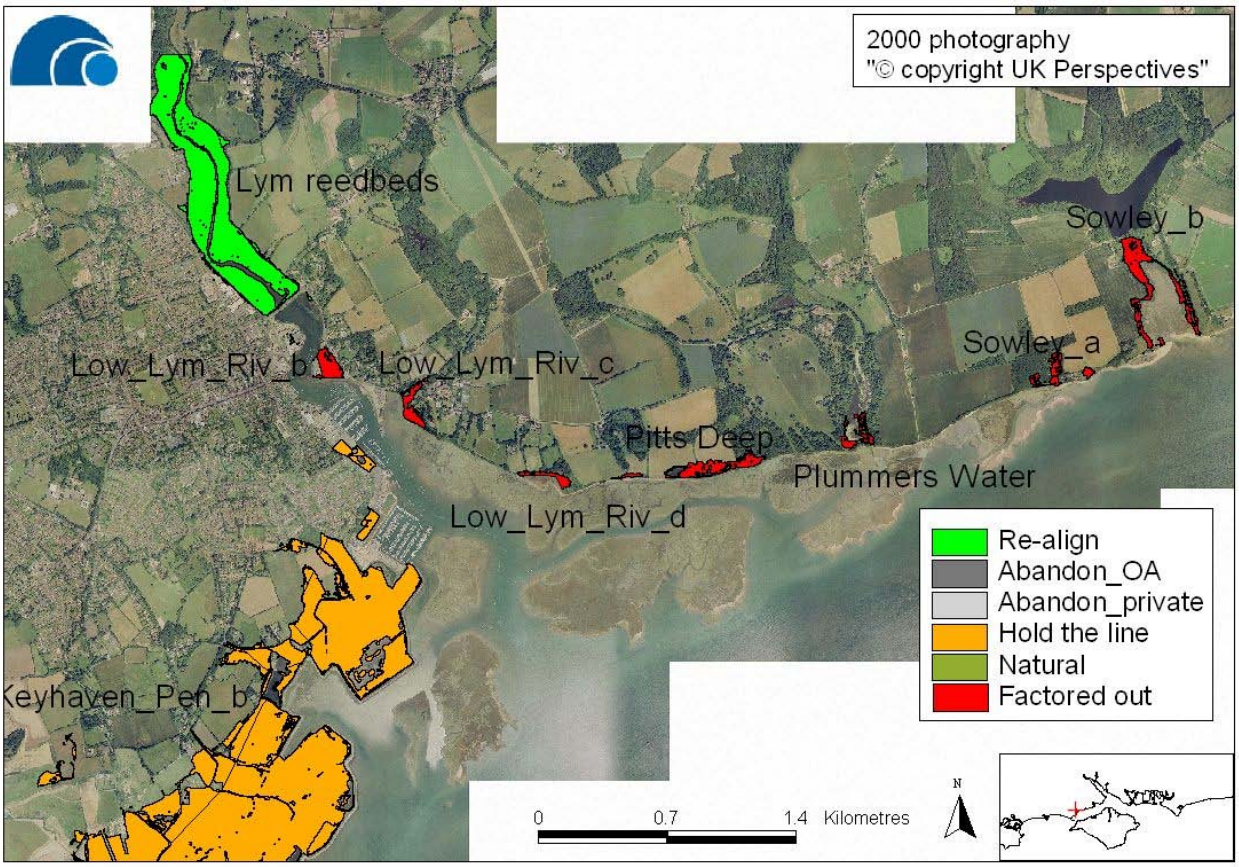


Figure 5.6a: Potential habitat creation sites

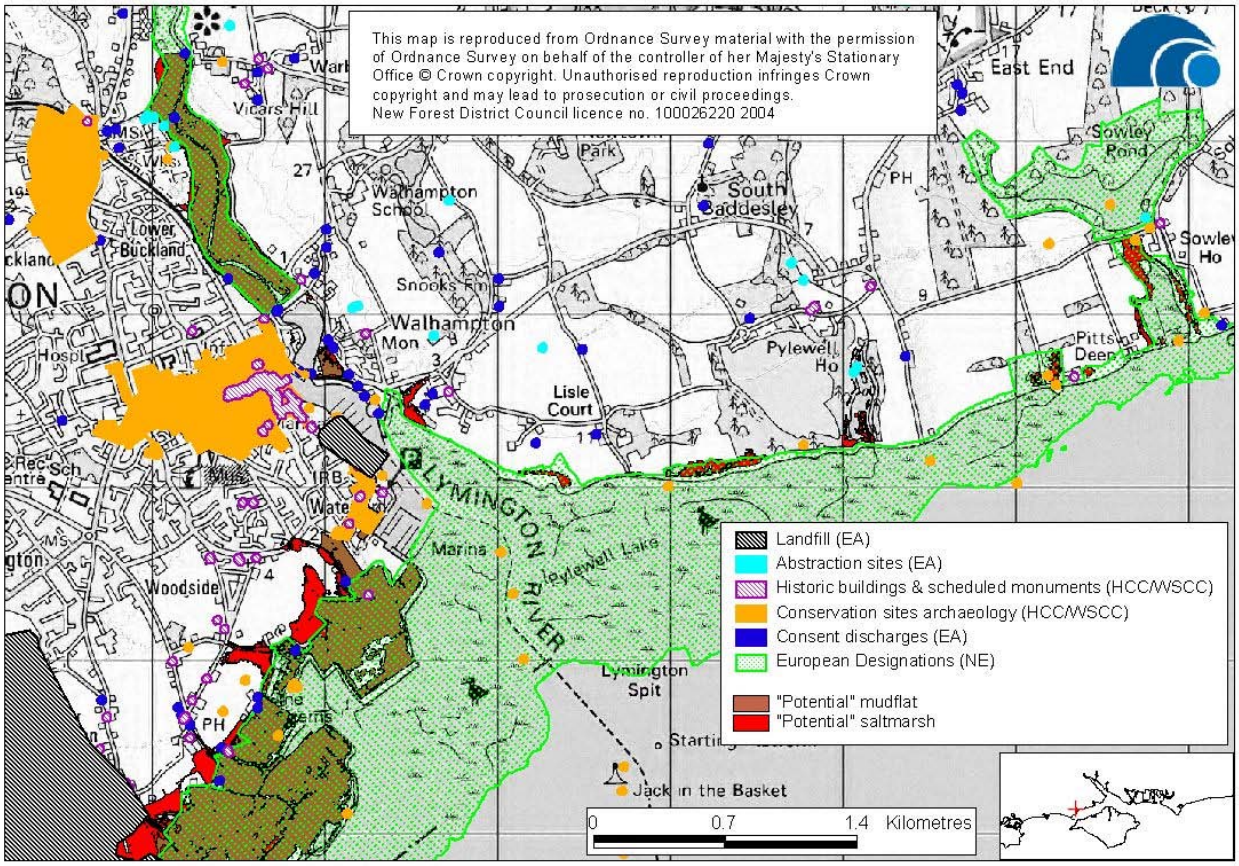


Figure 5.6b: Managed re-alignment constraints available as GIS layers

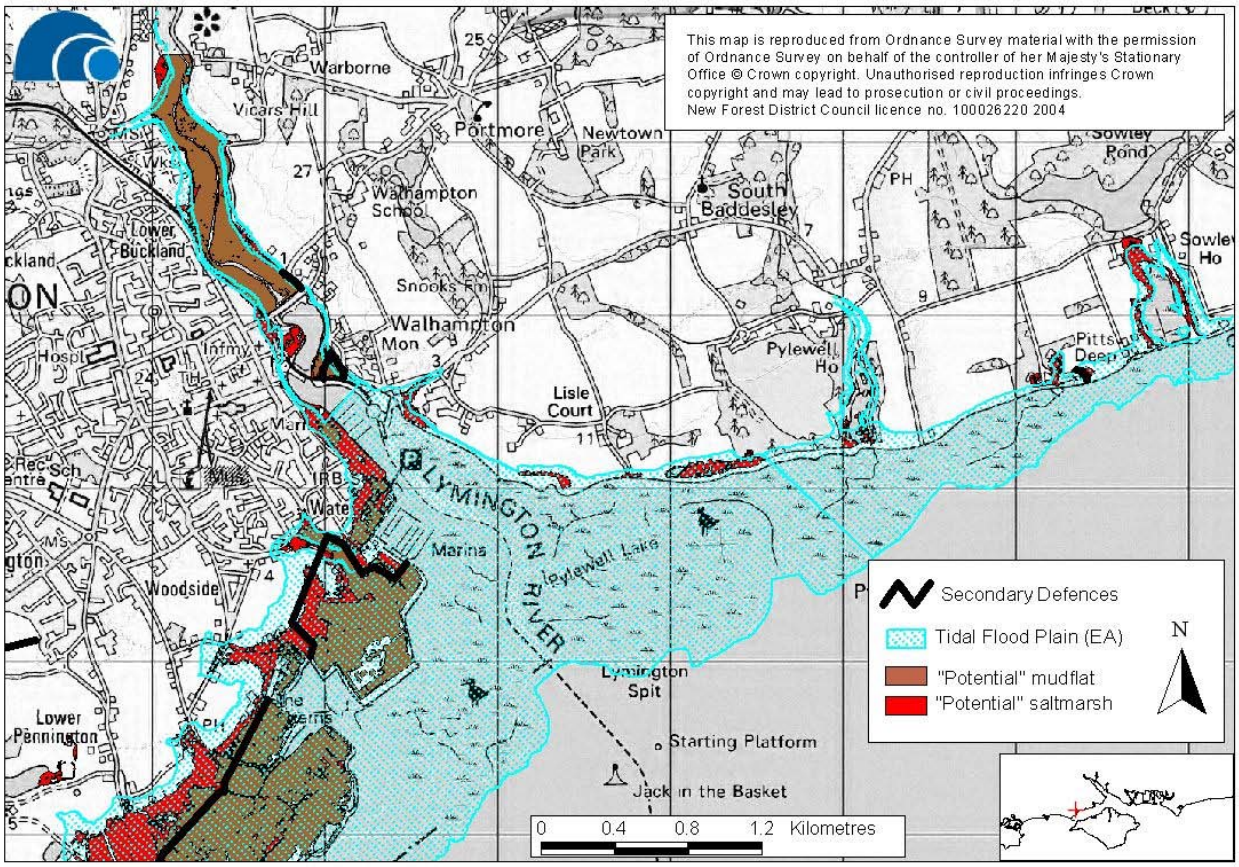


Figure 5.6c: Secondary defences required to protect development from tidal flooding.

The **Lymington Reedbed** (Lym_reedbed in Figure 5.6a) is recommended for **re-alignment** through RTE in epoch 0-19. The existing defence is predicted to come to the end of its residual life in 20-49 years. The defence is maintained by the EA. Saline intrusion will have a positive effect on the existing reedbed SPA which is in poor condition. The SPA will not require replacement habitat and any inter-tidal habitat created will be counted as mitigation. The site has the potential to create up to 33 ha of inter-tidal habitat under full re-alignment now and 37 ha of inter-tidal habitat in 100 years time. Under RTE there would be less habitat created. This site is currently undergoing a feasibility study by the EA into RTE, in order to improve the Lymington Reedbeds SSSI through the Water Level Management Plan.

Lower Lymington River b (Low_Lym_Riv_b), **Lower Lymington River c** (Low_Lym_Riv_c), **Lower Lymington River d** (Low_Lym_Riv_d), **Pitts Deep, Plummers Water, Sowley_a and Sowley_b** were **factored out** because they were too small in area to consider (Figure 5.6a).

5.3.5 Beaulieu

Potential habitat creation sites (Figure 5.7a), GIS constraints (Figure 5.7b) and requirement for secondary defences (Figure 5.7c) within the Beaulieu geographical unit are presented.

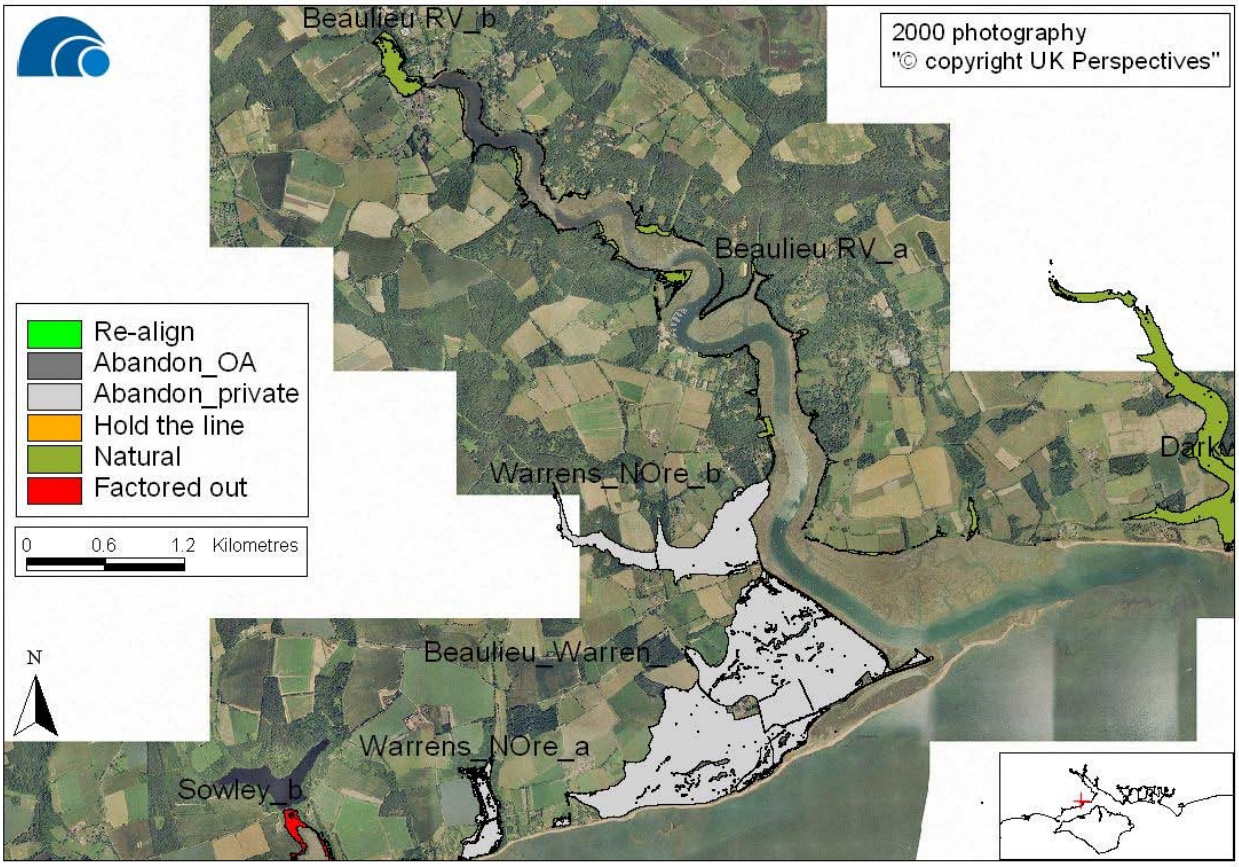


Figure 5.7a: Potential habitat creation sites

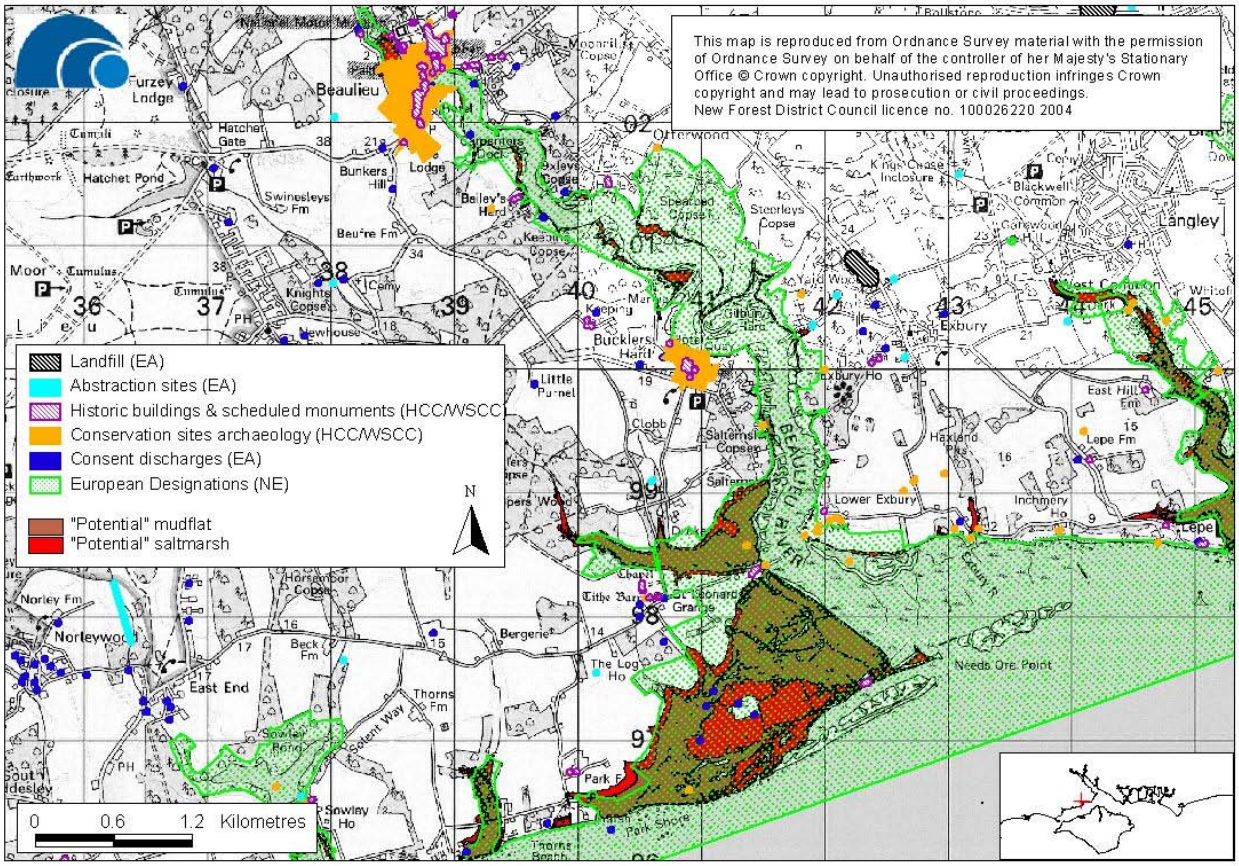


Figure 5.7b: Managed re-alignment constraints available as GIS layers

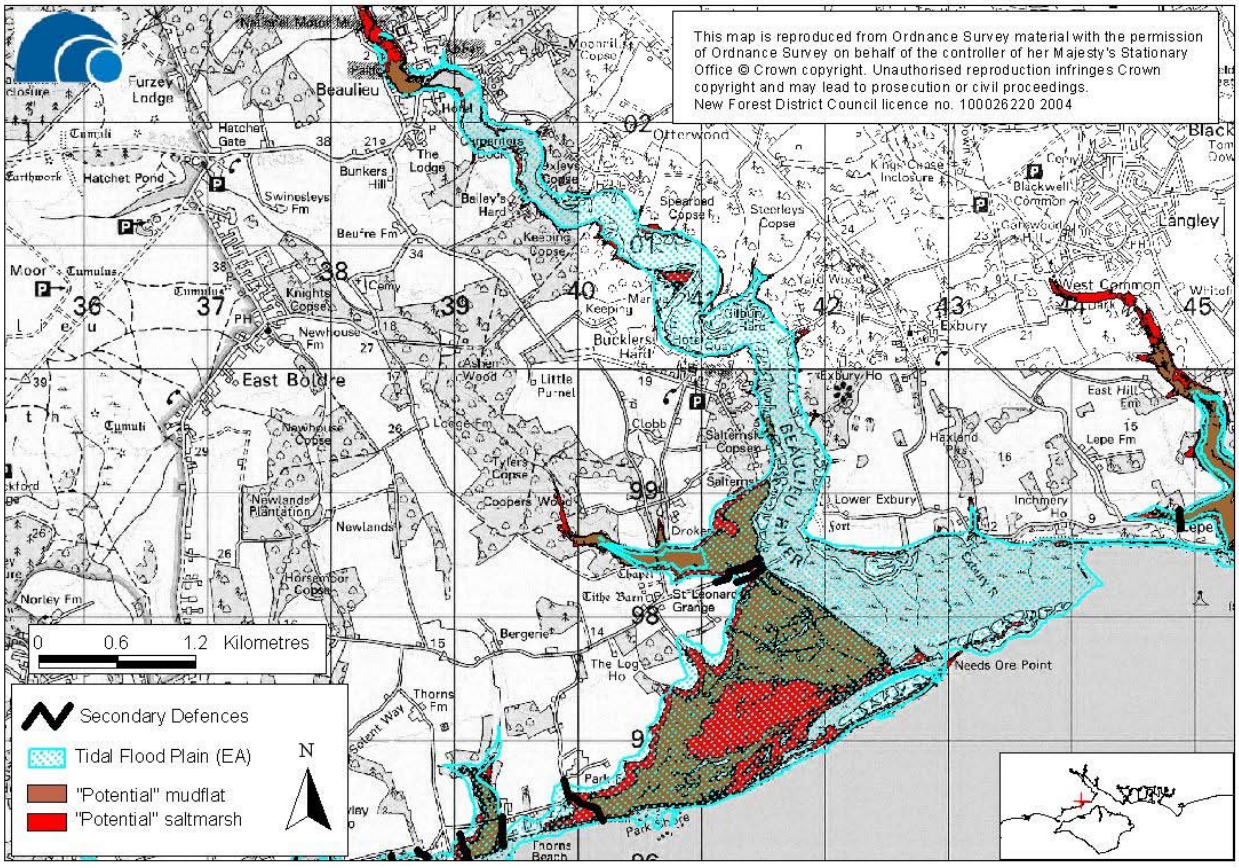


Figure 5.7c: Secondary defences required to protect development from tidal flooding.

The existing defence at **Warren Needs Ore a** (Warren NOre a, Figure 5.7a) is privately maintained. The site does not offer a positive benefit-cost to attract public funding. It is suggested that the end of its residual life is 0-19 years. However, if the owner wishes to continue to maintain the defence, on a like for like basis, it will be in the best interests of the SPA. If the site is ever fully abandoned or re-aligned then there is a need for 4 ha of replacement freshwater habitat (grazing marsh) which could take 50 years to re-create and will therefore require compensation to start **now**. This site has been categorised as **abandonment** in epoch 20-49 years. The site has the potential to create 7.4 ha of inter-tidal habitat if re-aligned now and 12.3 ha of inter-tidal habitat in 100 years time. The existing line of defence is approximately 400 m in length and any potential secondary defences would be approximately 500 m. Any change in management would require agreement from landowners.

The existing defence at **Beaulieu Warren** (Figure 5.7a) is privately maintained. The site does not offer a positive benefit-cost to attract public funding. It is suggested that the end of its residual life is 0-19 years. However, if the owner wishes to continue to maintain the defence, on a like for like basis, it will be in the best interests of the SPA. If the site is ever fully abandoned or re-aligned then there is a need for 193 ha of replacement freshwater habitat (grazing marsh) which could take 50 years to re-create and will therefore require compensation to start **now**. This site has been categorised as **abandonment** in epoch 20-49 years. The site has the potential to create 164 ha of inter-tidal habitat if re-aligned now and 193 ha of inter-tidal habitat in 100 years time. The existing line of defence is approximately 4600 m in length and any potential secondary defences would be approximately 737 m. The site is the largest freshwater SPA in the north Solent region. Any change in management would require agreement from landowners.

The existing defence at **Warren Needs Ore b** (Warren NOre b, Figure 5.7a) is privately maintained. The site does not offer a positive benefit-cost to attract public funding. It is suggested that the end of its residual life is 0-19 years. However, if the owner wishes to continue to maintain the defence, on a like for like basis, it will be in the best interests of the SPA. If the site is ever fully abandoned or re-aligned then there is a need for 44.3 ha of replacement freshwater habitat (grazing marsh) which could take 50 years to re-create and will therefore require compensation to start **now**. This site has been categorised as **abandonment** in epoch 20-49 years. The site has the potential to create 38.5 ha of inter-tidal habitat if re-aligned now and 44.3 ha of inter-tidal habitat in 100 years time. The existing line of defence is approximately 746 m in length and any potential secondary defences would be approximately 516 m. Any change in management would require agreement from landowners.

The remaining sites are **naturally occurring**.

5.3.6 Calshot

Potential habitat creation sites (Figure 5.8a), GIS constraints (Figure 5.8b) and requirement for secondary defences (Figure 5.8c) within the Darkwater to Calshot geographical unit are presented.

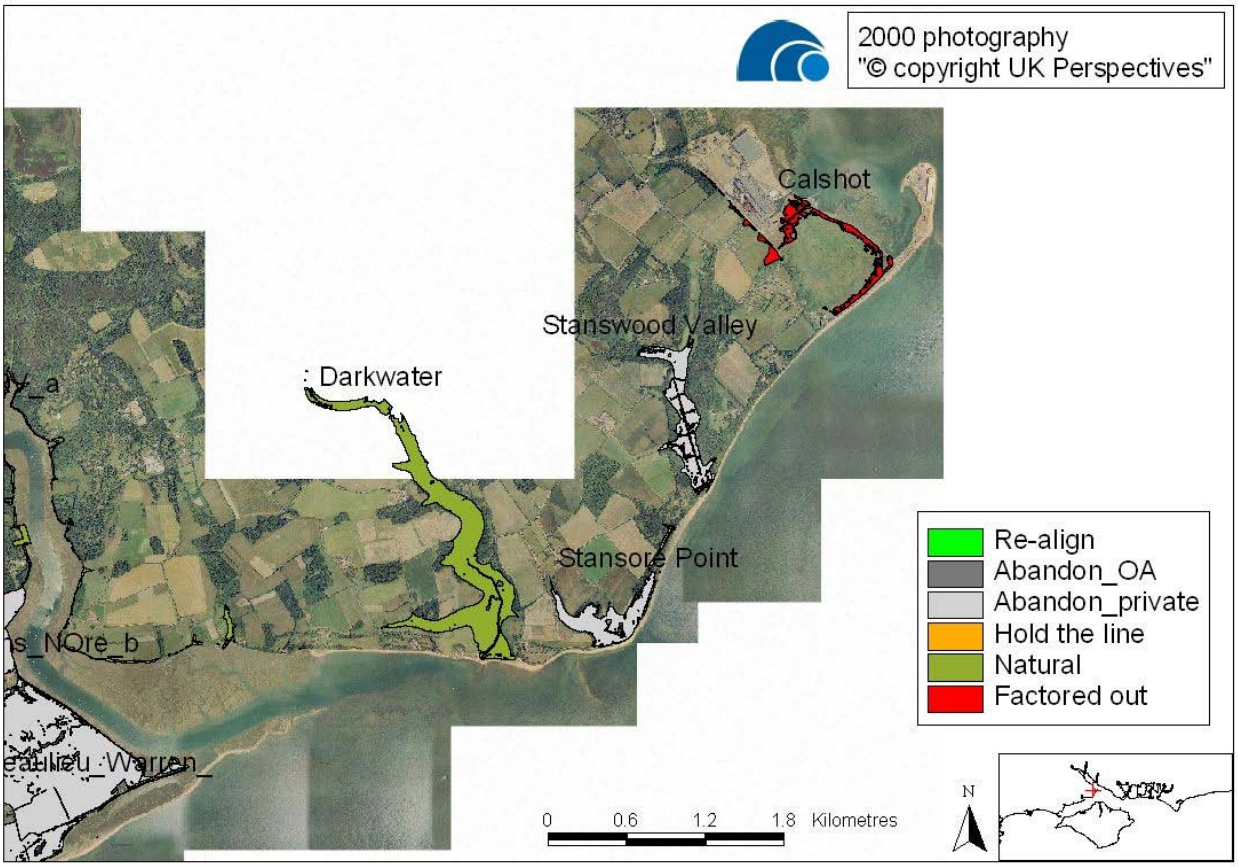


Figure 5.8a: Potential habitat creation sites

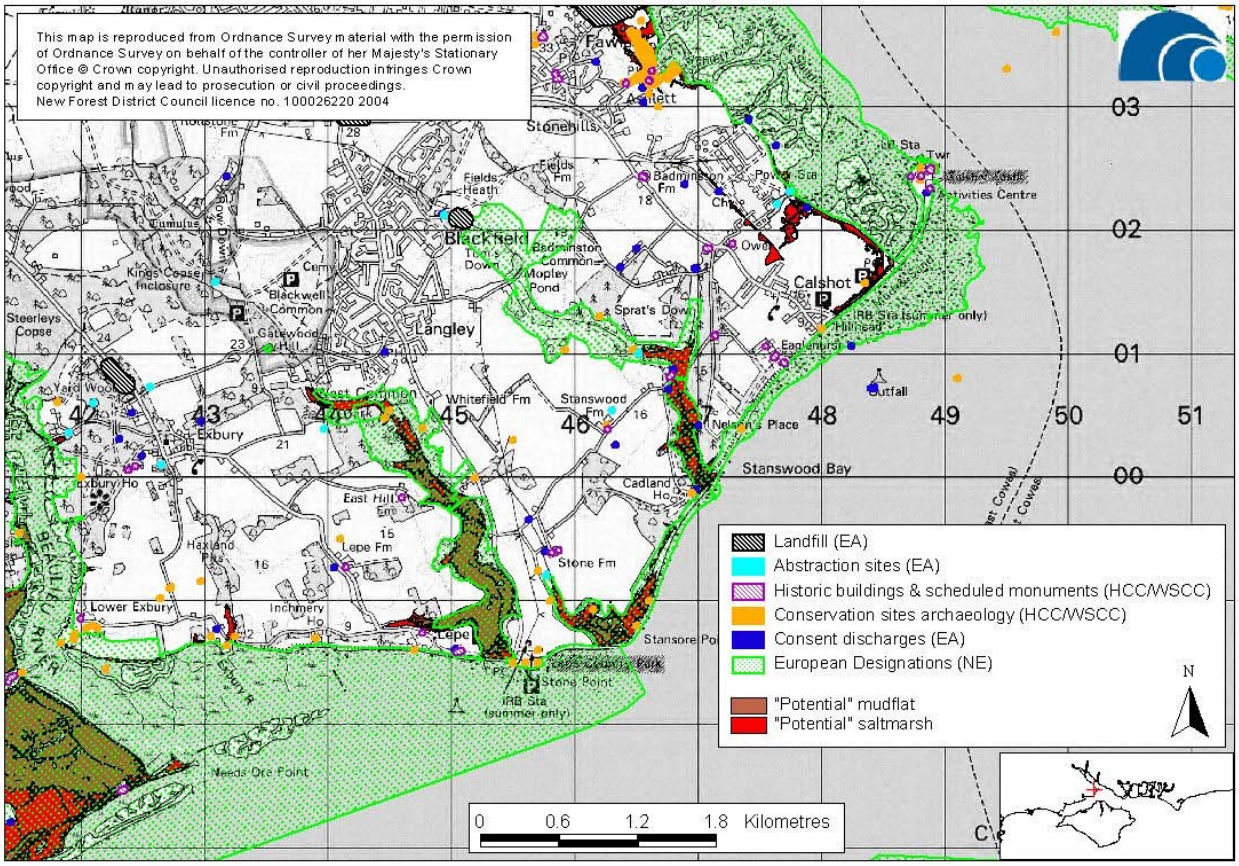


Figure 5.8b: Managed re-alignment constraints available as GIS layers

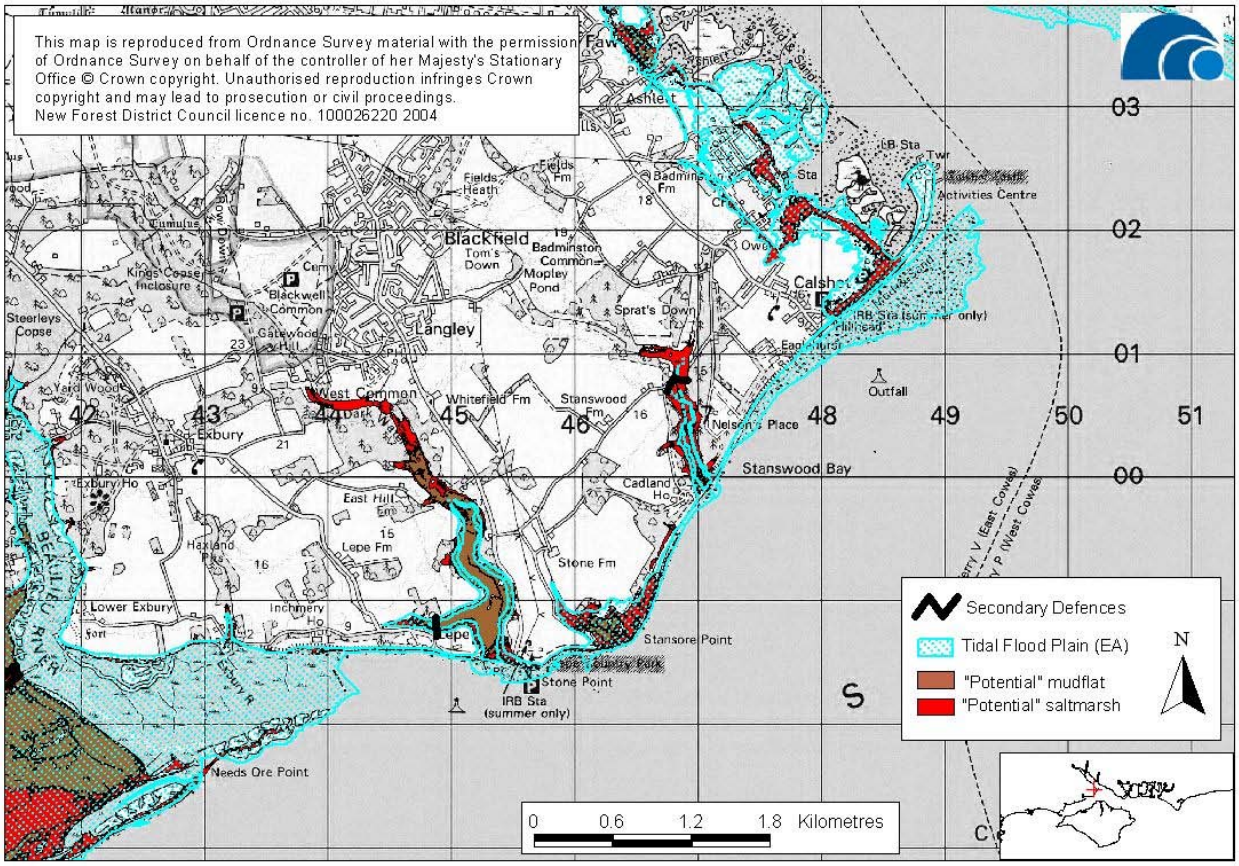


Figure 5.8c: Secondary defences required to protect development from tidal flooding.

The **Darkwater** is a naturally occurring site. Calshot was **factored out** because it is a former landfill site (Figure 5.8b).

The existing defence at **Stansore Point** (Figure 5.8a) is privately maintained. The site does not offer a positive benefit-cost to attract public funding. It is suggested that the end of its residual life is 0-19 years. NE will allow change to the existing SPA, therefore replacement habitat is not required. This site meets criteria for potential abandonment in epoch 0-19 years. The site has the potential to create 11.2 ha of inter-tidal habitat if re-aligned now and 15.4 ha of inter-tidal habitat in 100 years time. The existing line of defence is approximately 950 m in length. There is no need for any secondary defences because the site naturally rises onto higher ground. Any change in management would require agreement from landowners.

The existing defence at **Stanswood Valley** (Figure 5.8a) is privately maintained. The site does not offer a positive benefit-cost to attract public funding. It is suggested that the end of its residual life is 0-19 years. NE will allow change to the existing SSSI, therefore replacement habitat is not required. This site meets criteria for potential abandonment in epoch 0-19 years. The site has the potential to create 13.6 ha of inter-tidal habitat if re-aligned now and 13.7 ha of inter-tidal habitat in 100 years time. The existing line of defence is approximately 250 m in length and any potential secondary defences would be approximately 230 m. Any change in management would require agreement from landowners.

5.3.7 Southampton Water

Potential habitat creation sites (Figure 5.9a and 5.9d), GIS constraints (Figure 5.9b and 5.9e) and requirement for secondary defences (Figure 5.9c and 5.9f) within the Southampton Water geographical unit are presented.

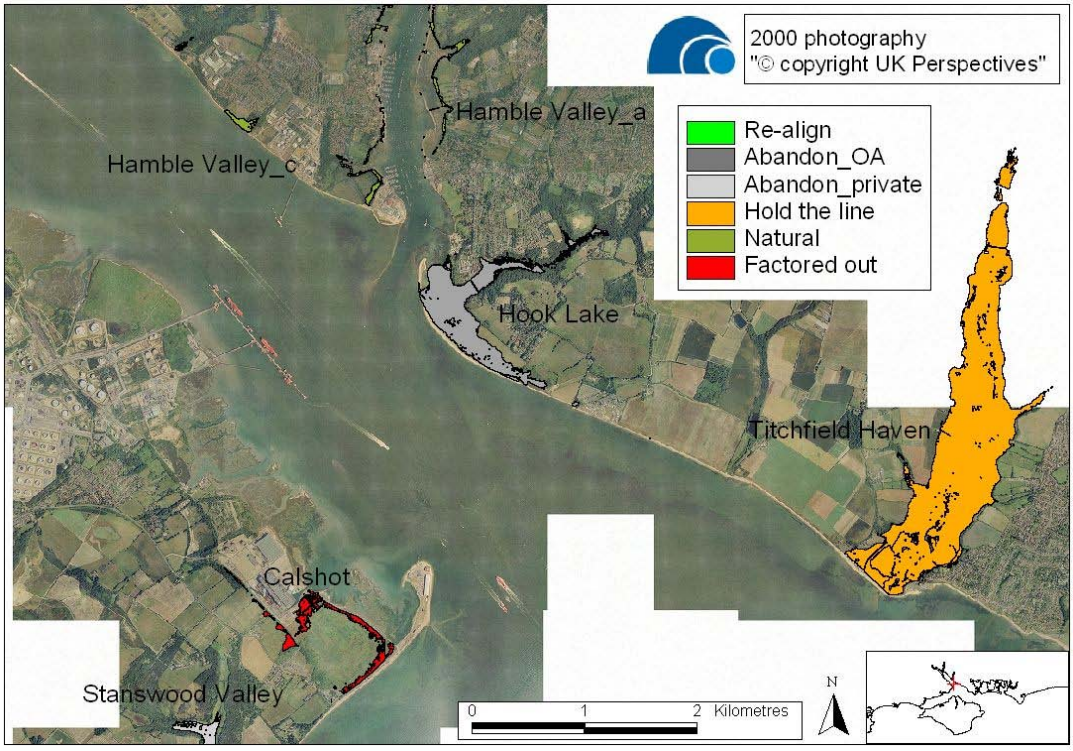


Figure 5.9a: Potential habitat creation sites

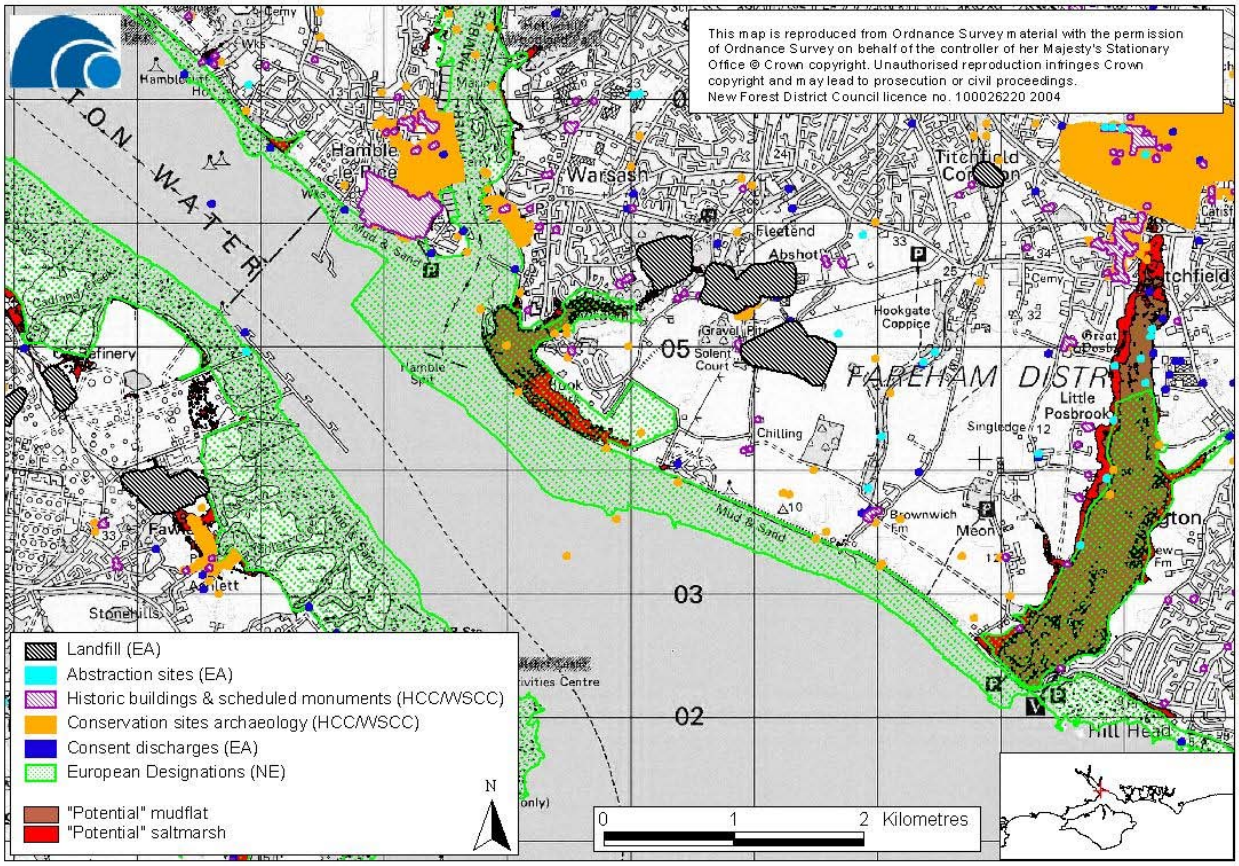


Figure 5.9b: Managed re-alignment constraints available as GIS layers (south)

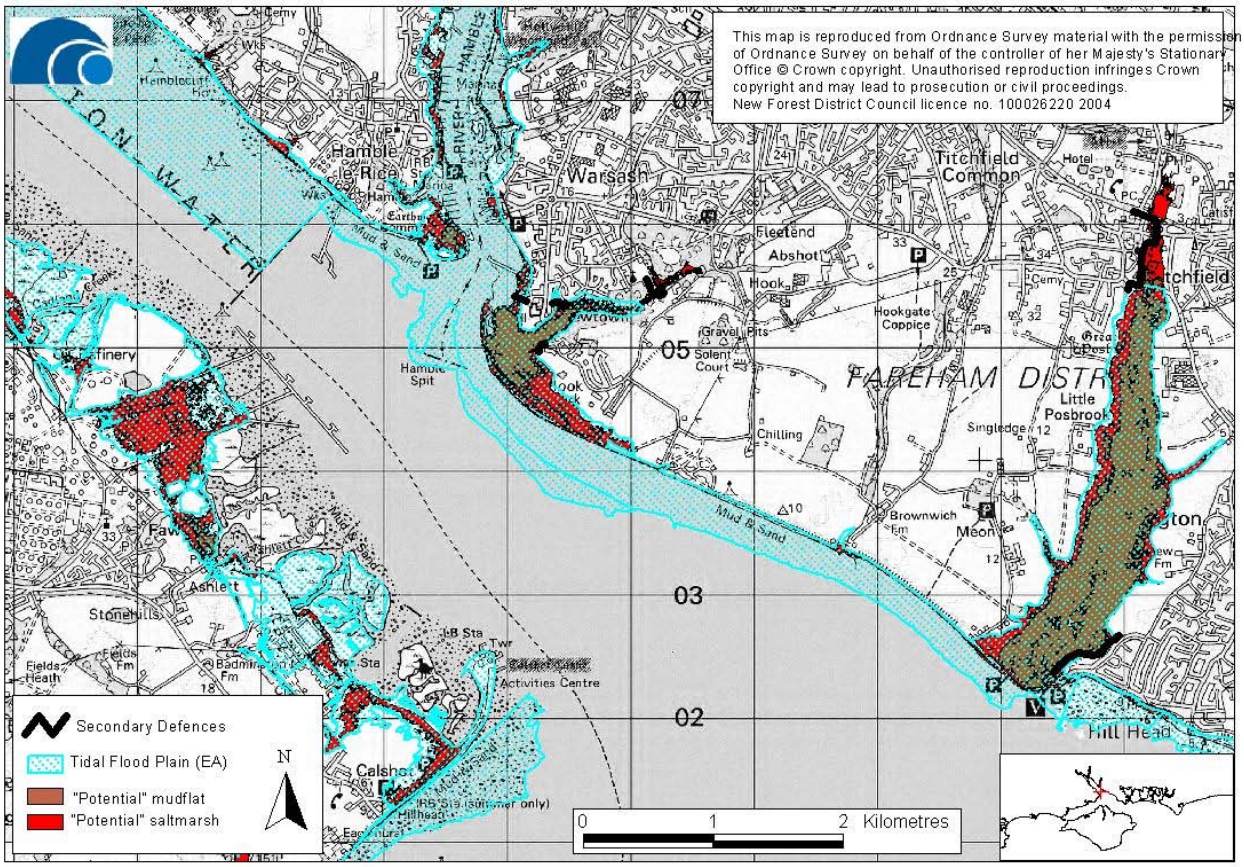


Figure 5.9c: Secondary defences required to protect development from tidal flooding (south).

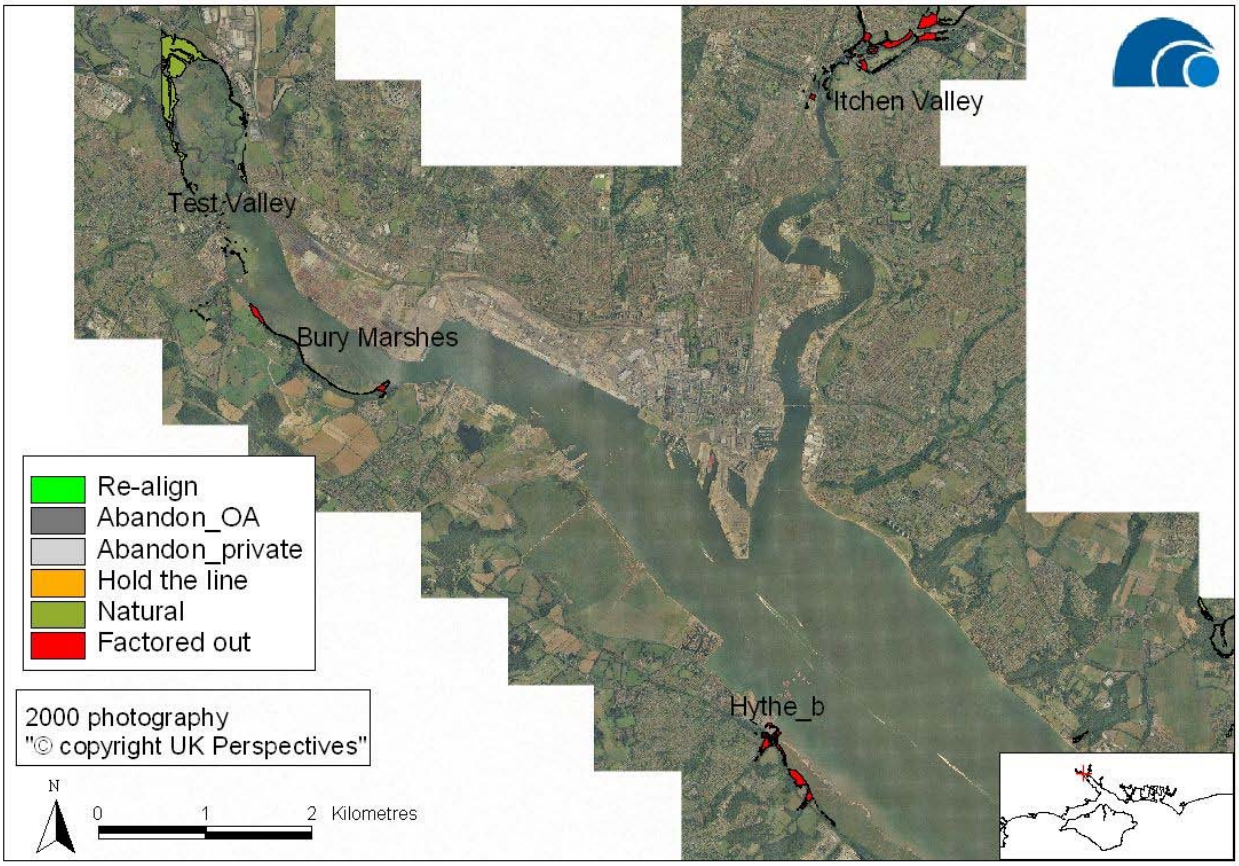


Figure 5.9d: Potential habitat creation sites for north Southampton Water

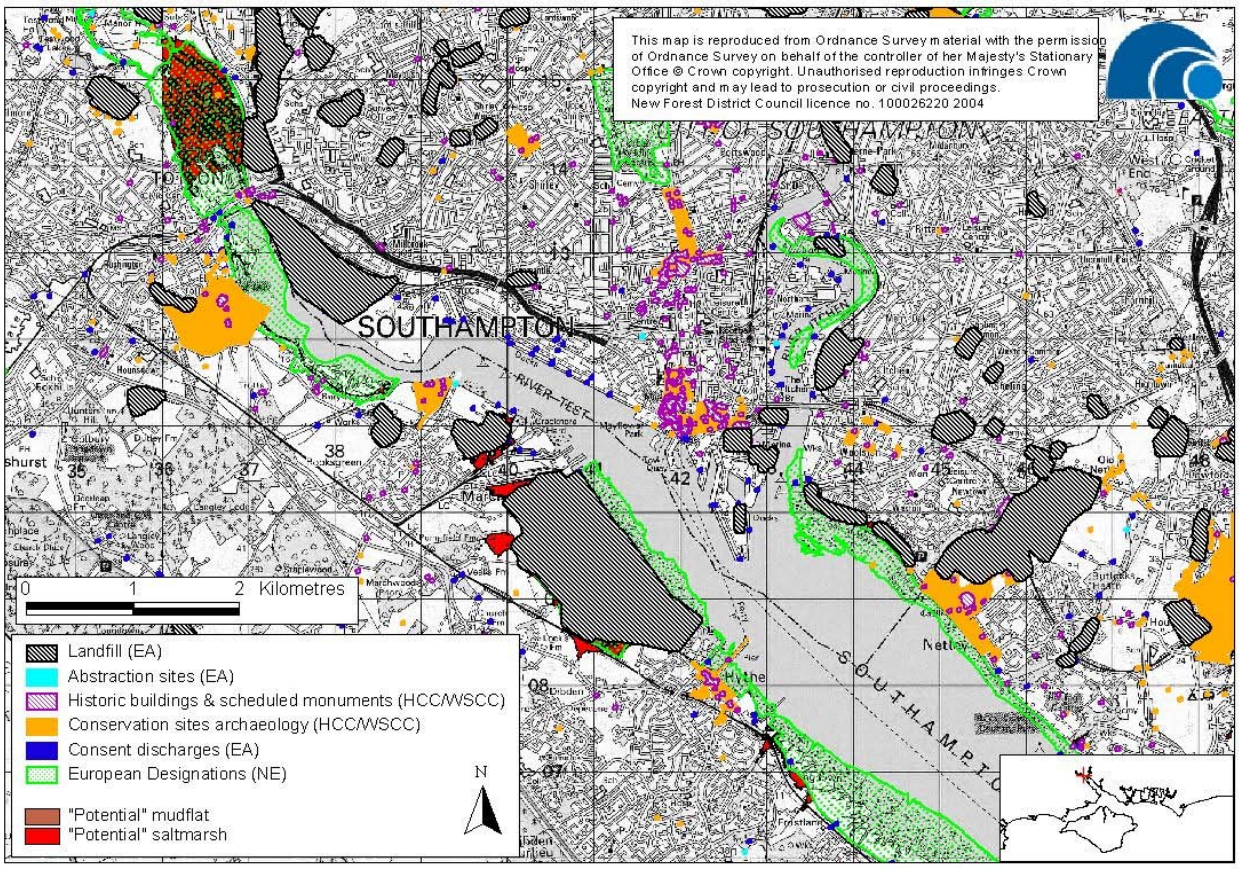


Figure 5.9e: Managed re-alignment constraints available as GIS layers (north)

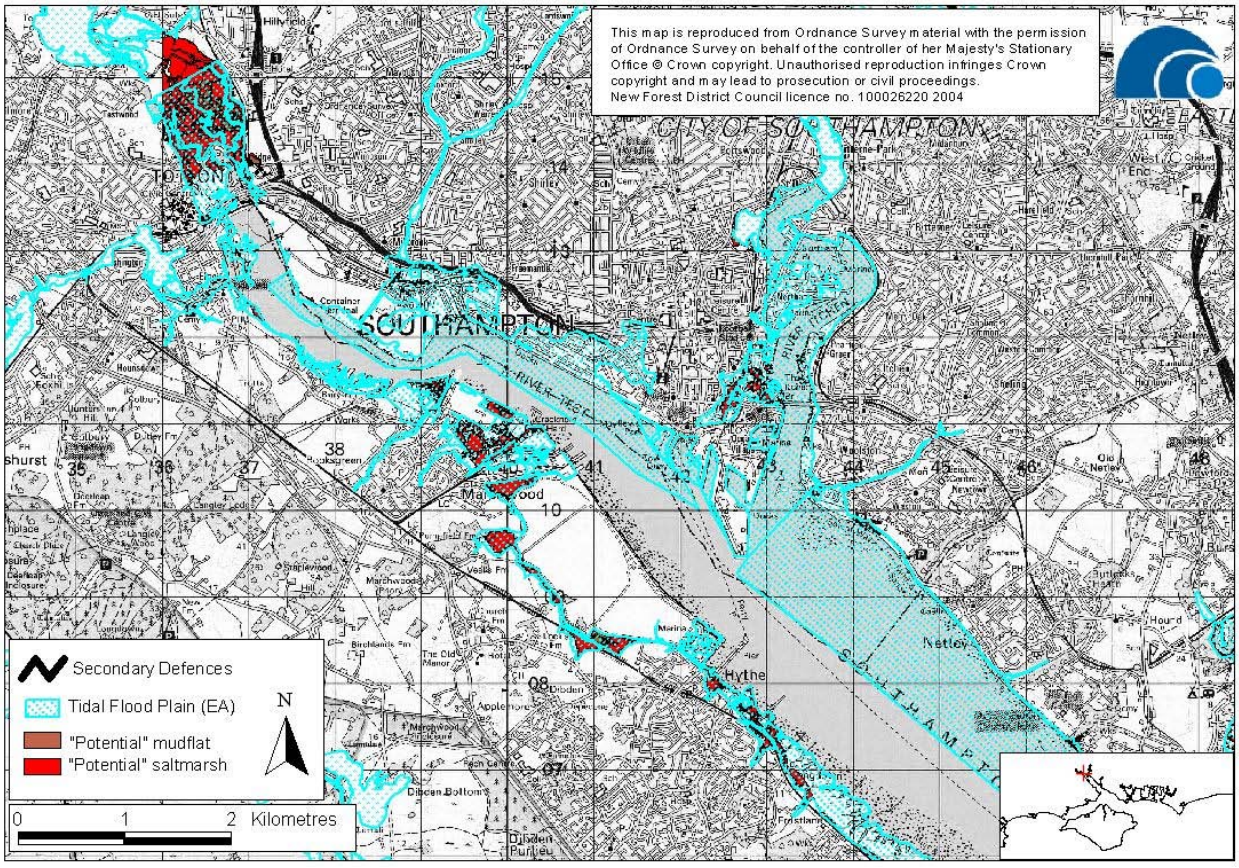


Figure 5.9f: Secondary defences required to protect development from tidal flooding (north).

Calshot, Hythe_b, Bury Marshes and the **Itchen Valley** (Figure 5.9b and 5.9e) have been **factored out** because they are former landfill sites. The Test Valley site (Figure 5.9d) is naturally occurring.

The defence at **Titchfield Haven** (Figure 5.9a) is maintained by the EA and HCC. The site is recommended for **hold the line** as there is a better benefit-cost on the existing route (1000 m) compared with the potential re-alignment route (1608 m). Realistically, because the site is an old river valley, RTE would be the only sensible option, rather than full re-alignment. Two secondary defences may still be required (Figure 5.9c). If the site were to undergo any saline intrusion through RTE then NE would not require replacement habitat.

5.3.8 Hamble

Potential habitat creation sites (Figure 5.10a), GIS constraints (Figure 5.10b) and requirement for secondary defences (Figure 5.10c) are presented.

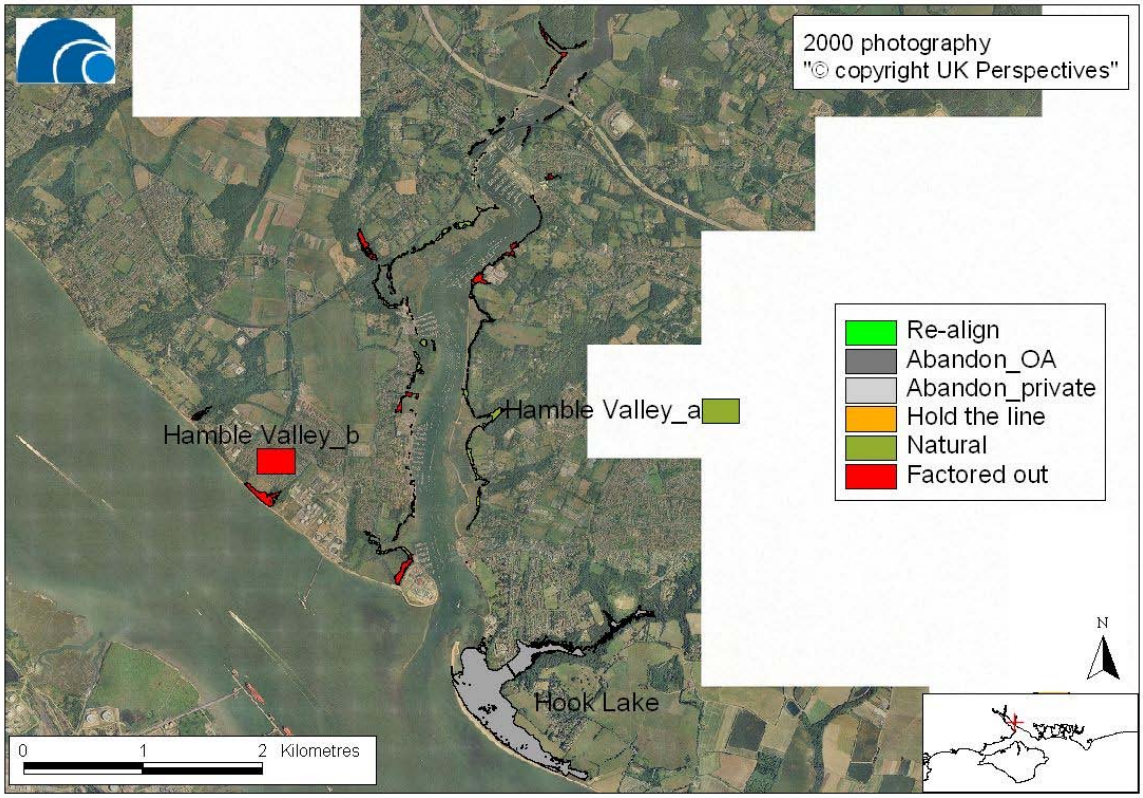


Figure 5.10a: Potential habitat creation sites for the Hamble

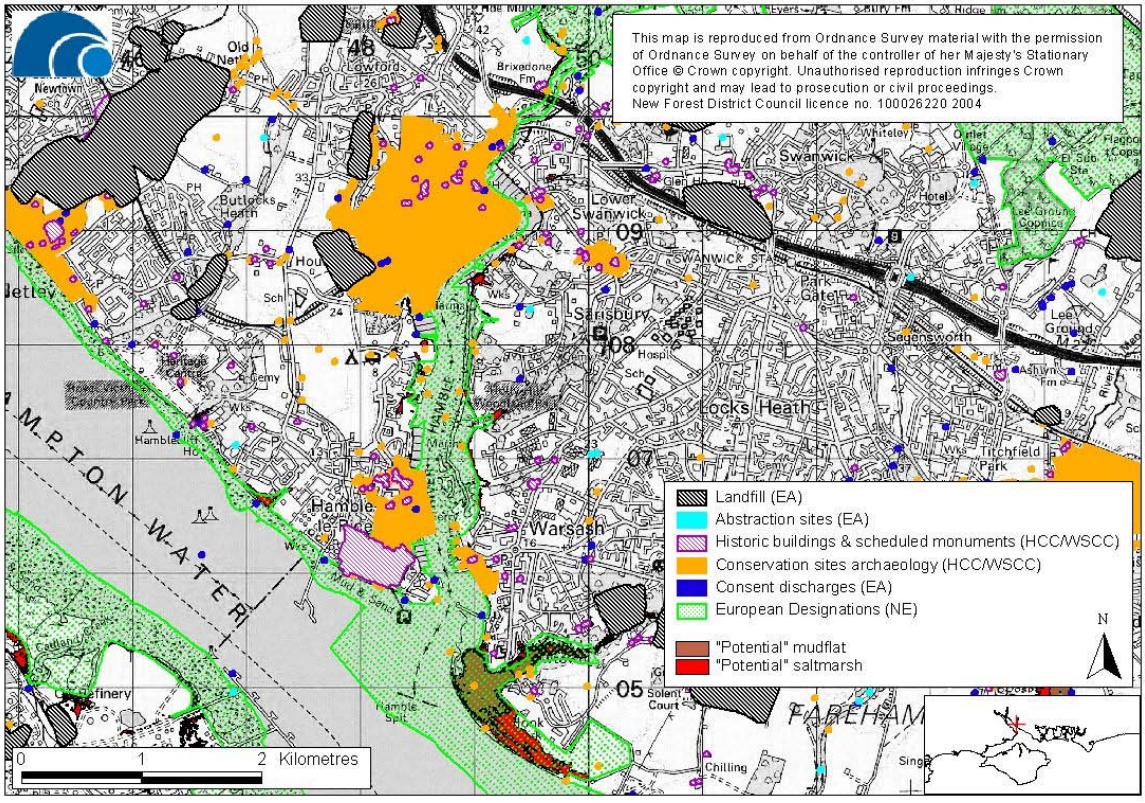


Figure 5.10b: Managed re-alignment constraints available as GIS layers (north)

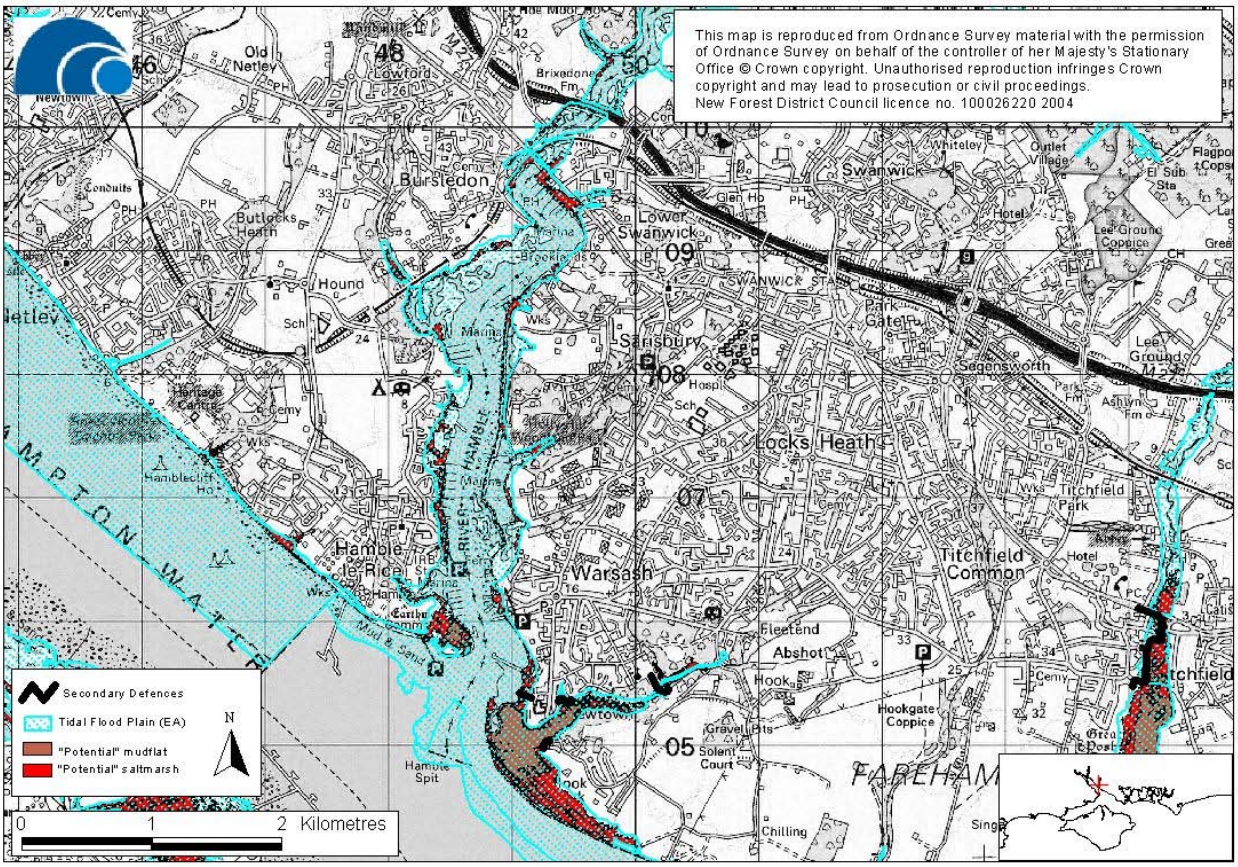


Figure 5.10c: Secondary defences required to protect development from tidal flooding (north).

Hamble Valley_a, Hamble Valley_b and **Hamble Valley_c** are all **naturally occurring**.

The existing defence at **Hook Lake** (Figure 5.10a) is maintained by the EA. It is suggested that the end of its residual life is 0-19 years. NE will allow change to the existing SPA, therefore replacement habitat is not required. This site has been categorised as **abandonment** in epoch 0-19 years. The site has the potential to create 33 ha of inter-tidal habitat if re-aligned now and 46 ha of inter-tidal habitat in 100 years time. The existing line of defence is approximately 2120 m in length and any potential secondary defences would be approximately 550 m.

5.3.9 Portsmouth Harbour

Potential habitat creation sites (Figure 5.11a), GIS constraints (Figure 5.11b) and requirement for secondary defences (Figure 5.11c) within the Portsmouth Harbour geographical unit are presented.

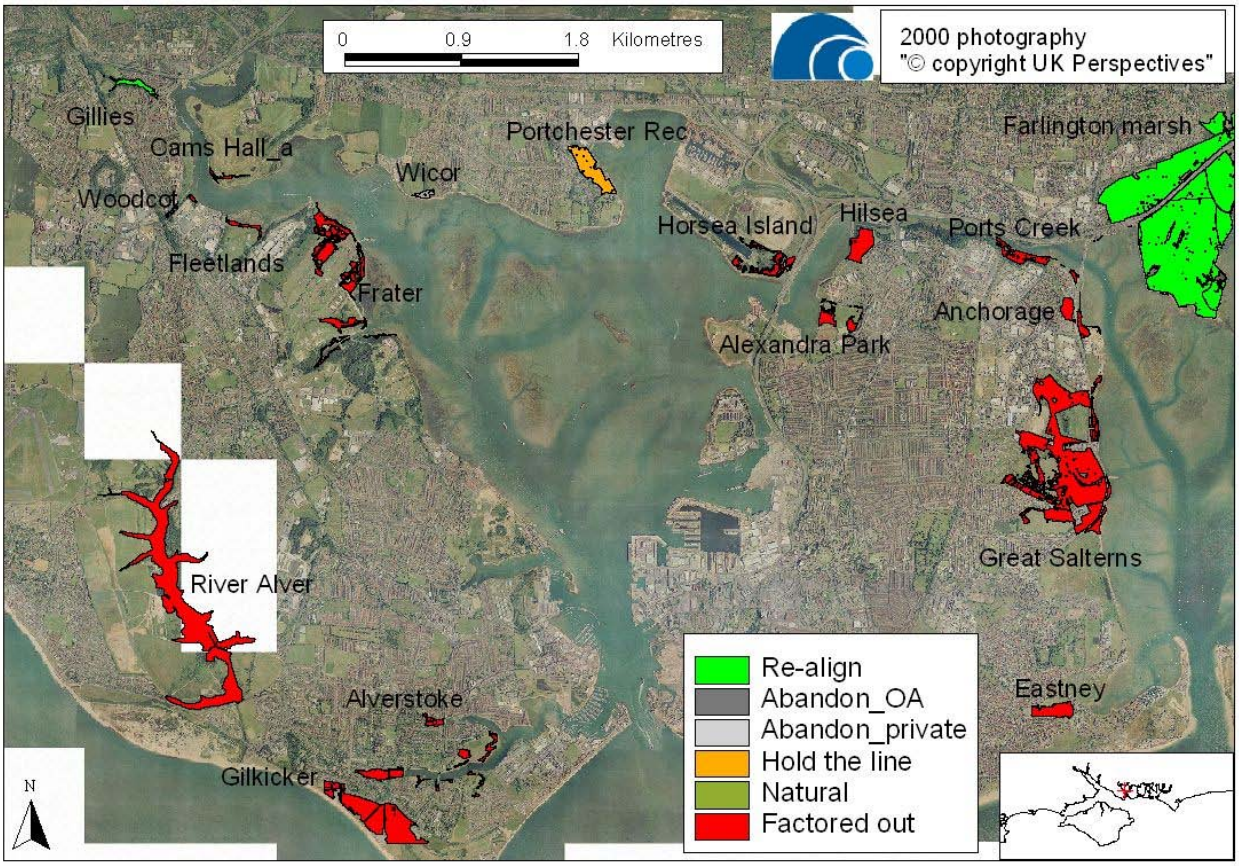


Figure 5.11a: Potential habitat creation sites

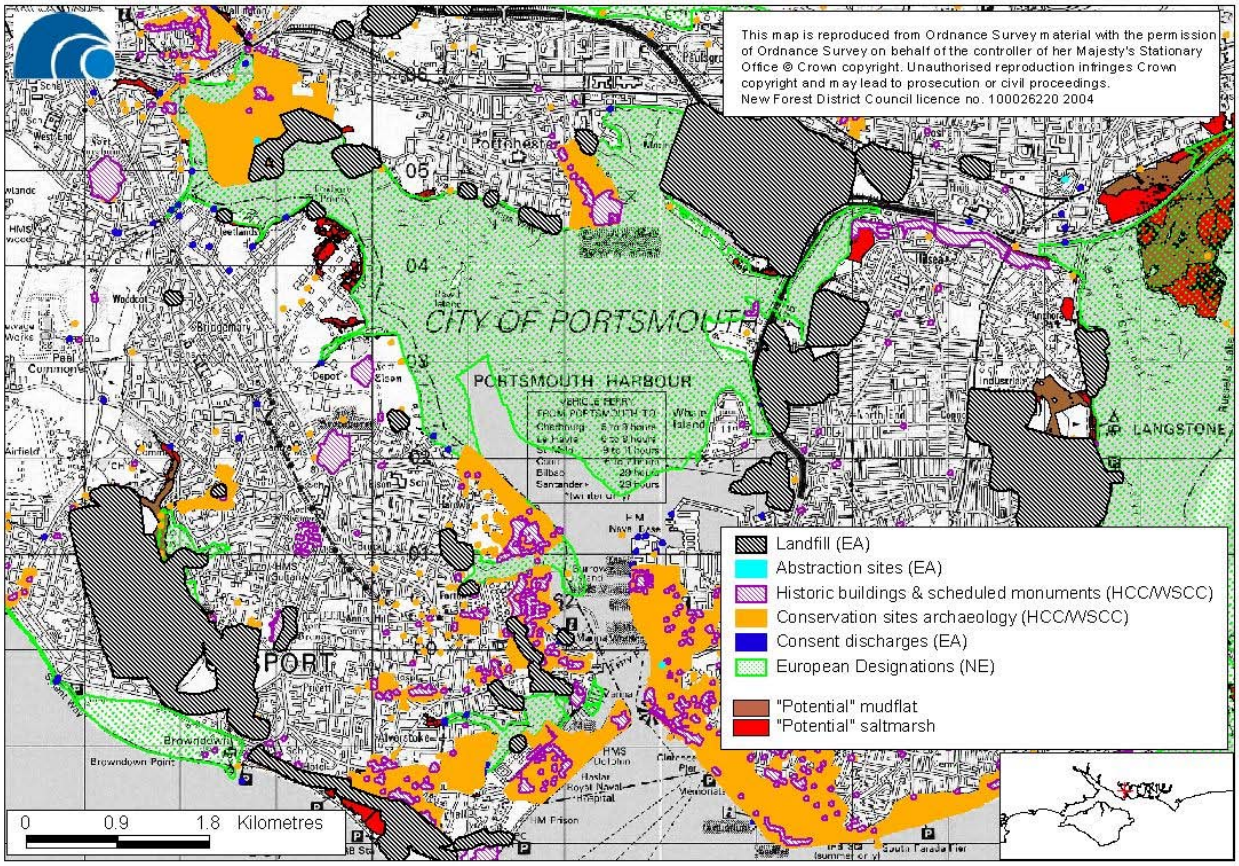


Figure 5.11b: Managed re-alignment constraints available as GIS layers

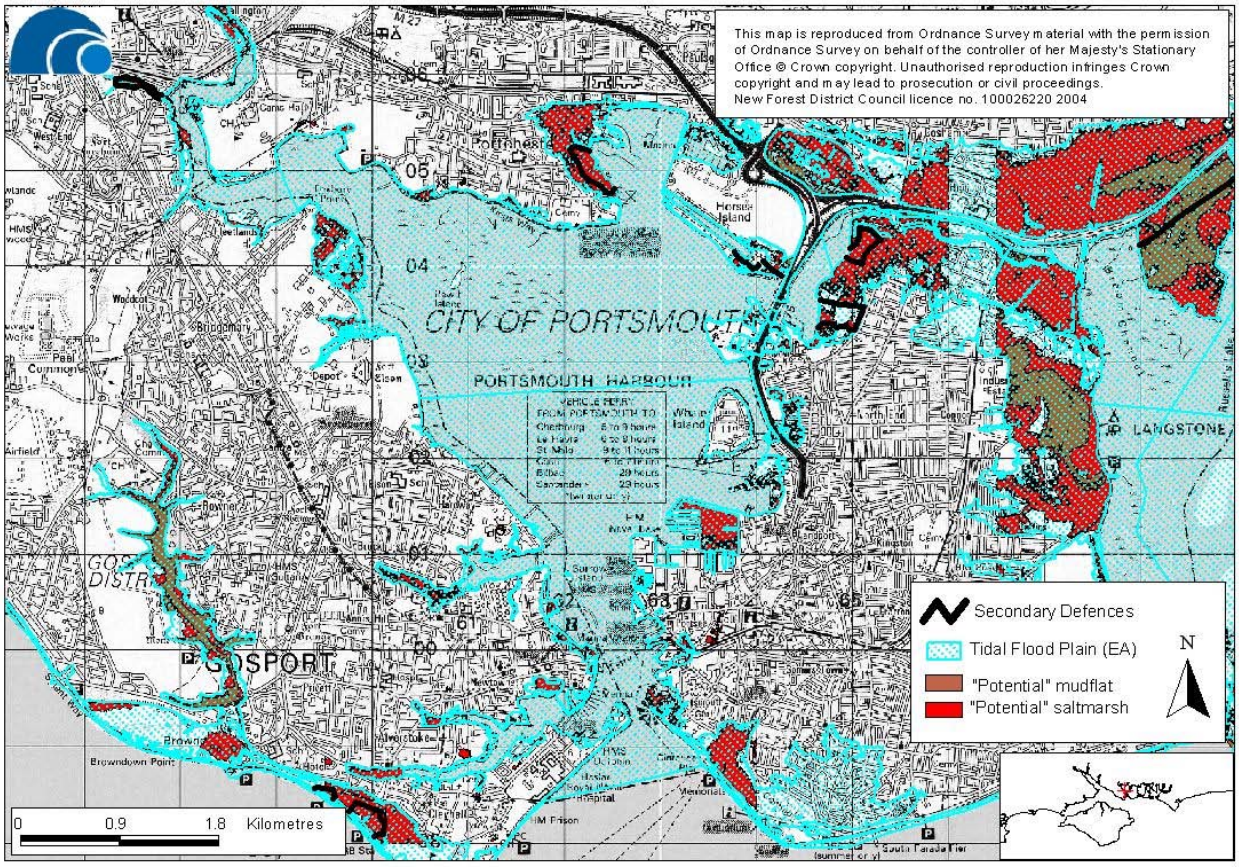


Figure 5.11c: Secondary defences required to protect development from tidal flooding.

The **River Alver, Gilkicker, Alverstoke, Fleetlands, Woodcot, Cams Hall_a, Horsea Island** and **Alexandra Park** were all **factored out** because they are former landfill sites. The **Frater site** was **factored out** because it was relatively small and MOD land. The **Hilsea site** was **factored out** because the secondary defence would have to be approximately 10 times longer than the existing defence.

The **Gillies Stream** (Figure 5.11a) is recommended for **re-alignment** through RTE in epoch 0-19. The site is an old river valley, therefore RTE would be the only sensible option, rather than full re-alignment. The existing defence is thought to be a pipe and it's residual life is unknown. The site is non-designated and has the potential to create up to 1.4 ha of inter-tidal habitat under full re-alignment now and 2.2 ha of inter-tidal habitat in 100 years time. Under RTE there would be less habitat created.

The existing defence at **Wicor** (Figure 5.11a) is maintained by Fareham Borough Council. The site does not offer a positive benefit-cost for continued management. It is suggested that the end of its residual life is 0-19 years, therefore the site has been categorised as **abandonment** in epoch 0-19 years. The site has the potential to create 0.1 ha of inter-tidal habitat if re-aligned now and 1 ha of inter-tidal habitat in 100 years time. The existing line of defence is approximately 378 m in length. There is no need for any secondary defences because the site naturally rises onto higher ground. The site is non-designated.

The defence at **Portchester recreational ground** (Portchester Rec in Figure 5.11a) is maintained by the EA. The site is recommended for **hold the line** as there is a better benefit-cost on the existing route (570 m) compared with the potential re-alignment route (936 m). The site has the potential to create 5 ha of inter-tidal habitat if re-aligned now and 8.1 ha of inter-tidal habitat in 100 years time if the secondary defence depicted in Figure 3.8 was built. The site is non-designated.

5.3.10 Langstone Harbour

Potential habitat creation sites (Figure 5.12a), GIS constraints (Figure 5.12b) and requirement for secondary defences (Figure 5.12c) within the Langstone Harbour geographical unit are presented.

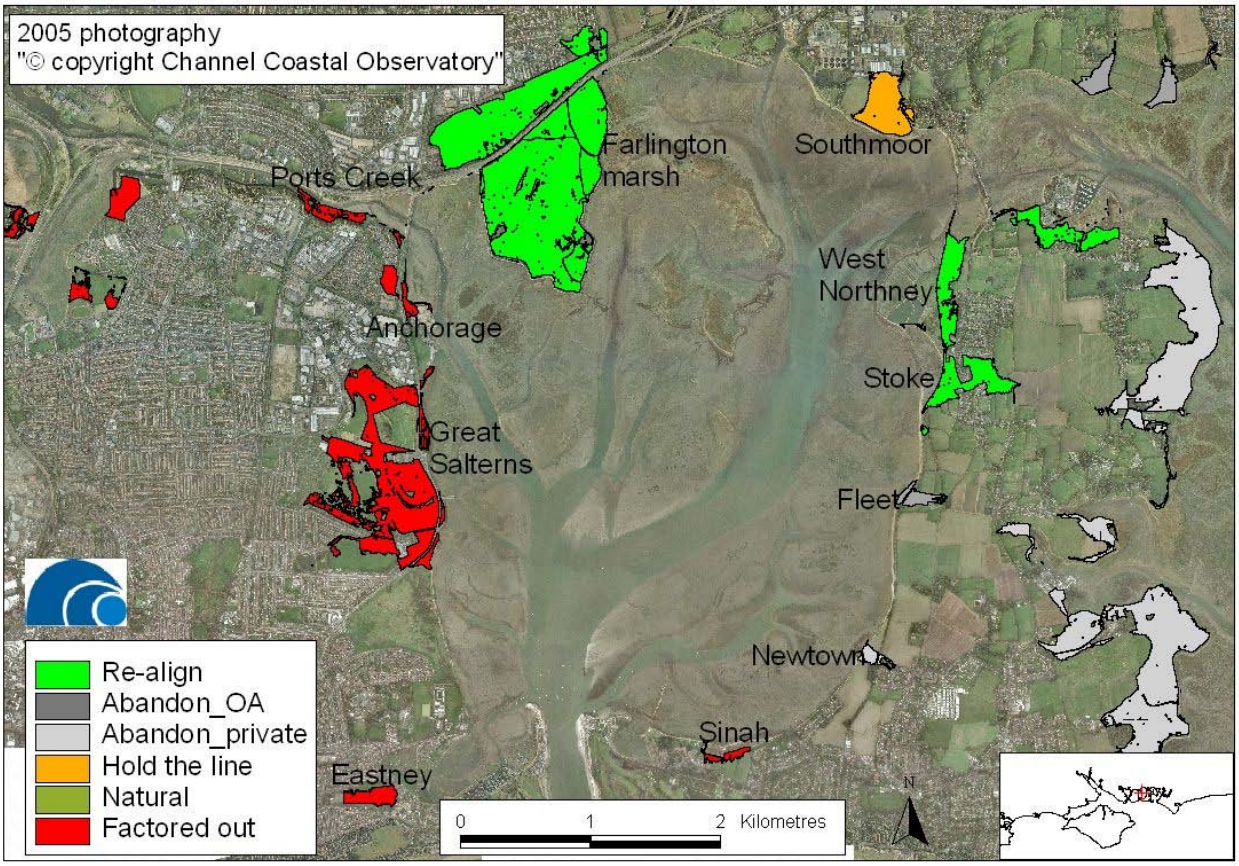


Figure 5.12a: Potential habitat creation sites

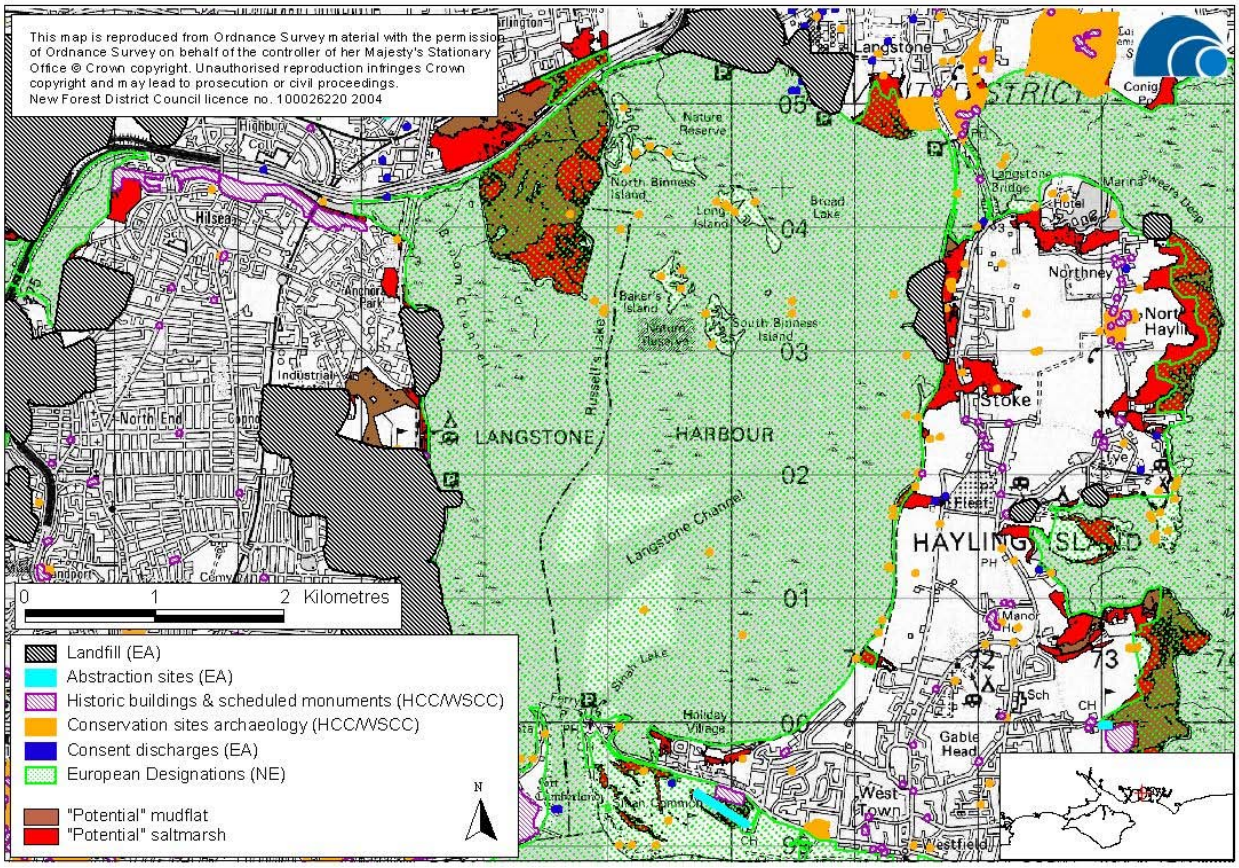


Figure 5.12b: Managed re-alignment constraints available as GIS layers

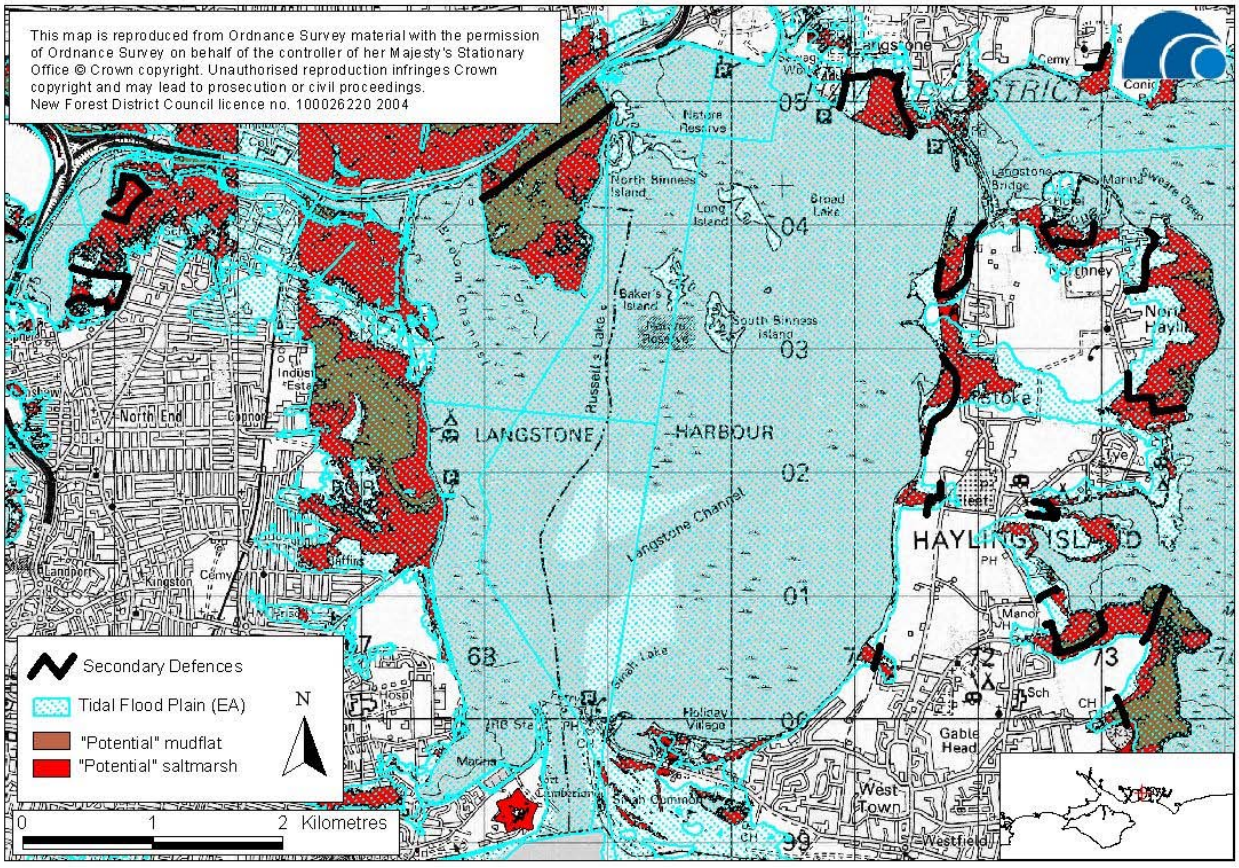


Figure 5.12c: Secondary defences required to protect development from tidal flooding.

Eastney, Great Salterns and **Anchorage** were all **factored out** because they are former landfill sites. **Ports Creek** was **factored out** because of the railway line and **Sinah** was **factored out** because the site was too small compared to the potential gain.

Farlington Marshes (Figure 5.12a) is recommended for **re-alignment** in epoch 0-19. The current defence, maintained by the EA, is in very poor condition and not economically viable to maintain on the current line. The existing line of defence is 3500 m, whilst the potential secondary line of defence is only 1300 m. The site has the potential to create up to 74 ha of inter-tidal habitat via partial re-alignment now and the same area in 100 years time. However, from a designation point of view, it would be better to realign later so as to allow replacement habitat to develop. There is a need for 74 ha of replacement freshwater habitat (grazing marsh) which could take 50 years to re-create and will therefore require compensation to start **now**. The reason for partial realignment is for flood storage.

The defence at **Southmoor** (Figure 5.12a) is privately maintained. However, because of a positive benefit-cost the EA may lead on future maintenance. If this is the case, **hold the line** is recommended as there is better benefit-cost on the existing route (652 m) compared with the potential re-alignment route (1243 m). The site has the potential to create 12.2 ha of inter-tidal habitat if re-aligned now and 13.9 ha of inter-tidal habitat in 100 years time if the secondary defence depicted in Figure 3.8 was built. The site is designated as a SPA and would require replacement habitat if re-alignment took place, which tips the balance towards holding the line. The Portchester to Emsworth CDS may recommend re-alignment to offset coastal squeeze within the strategy area as part of the appropriate assessment.

The existing defence at the **West Northney** (Figure 5.15a) site is maintained by HCC. The site is recommended for **re-alignment** in epoch 0-19. Because of the landfill to the west of the site, there is the same benefit-cost on the existing route (1000 m), compared with the re-aligned route (1050 m). The site is non-designated and has the potential to create up to 4.8 ha of inter-tidal habitat under full re-alignment now and 7 ha of inter-tidal habitat in 100 years time.

The existing defence at **Stoke** (Figure 5.12a) is maintained by the EA. The site is recommended for **re-alignment** in epoch 50-99. There is the same benefit-cost on the existing route (960 m), compared with the re-aligned route (899 m). The site is non-designated and has the potential to create up to 2.7 ha of inter-tidal habitat under full re-alignment now and 4.6 ha of inter-tidal habitat in 100 years time.

The existing defence at **Fleet** (Figure 5.12a) is maintained by HCC. The site does not offer a positive benefit-cost for continued management. It is suggested that the residual life of the defence is 0-19 years, therefore the site meets criteria for potential **abandonment** in epoch 0-19 years. However, HCC's Hayling Billy forms the defence and a decision needs to be made as to whether there are sufficient political/social reasons to hold the line. The site has the potential to create 1.3 ha of inter-tidal habitat if re-aligned now and 2.3 ha of inter-tidal habitat in 100 years time. The existing line of defence is approximately 385 m in length and any potential secondary defences would be approximately 330 m.

The existing defence at **Newtown** (Figure 5.12a) is privately maintained. The site does not offer a positive benefit-cost for public funding along the existing line of defence. It is

suggested that the end of its residual life is 20-49 years, therefore the site meets criteria for potential abandonment in 20-49 years. NE will allow change to the existing SPA, therefore replacement habitat is not required. The site has the potential to create 1.1 ha of inter-tidal habitat if re-aligned now and 1.6 ha of inter-tidal habitat in 100 years time. The existing line of defence is approximately 120 m in length and any potential secondary defences would be approximately 190 m to protect the Hayling Billy. Any change in management would require agreement from landowners.

5.3.11 Chichester Harbour

Potential habitat creation sites (Figure 5.13a), GIS constraints (Figure 5.13b) and requirement for secondary defences (Figure 5.13c) within the Chichester Harbour geographical unit are presented.

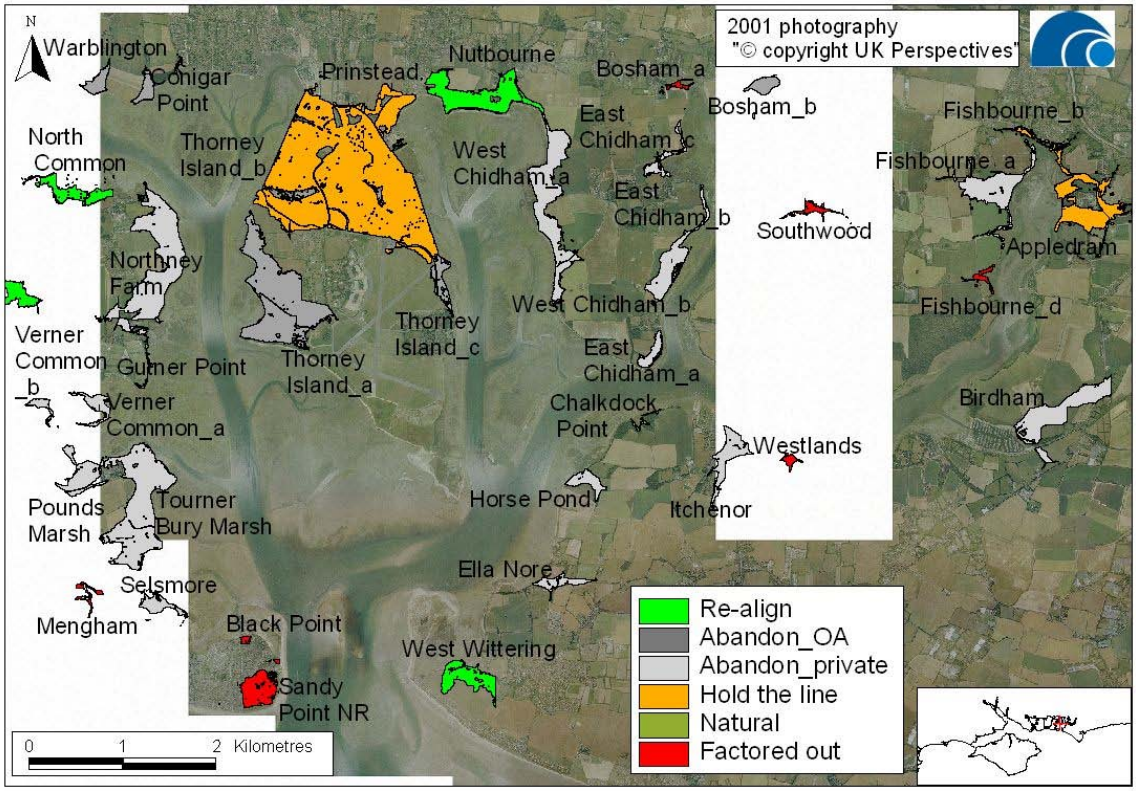


Figure 5.13a: Potential habitat creation sites

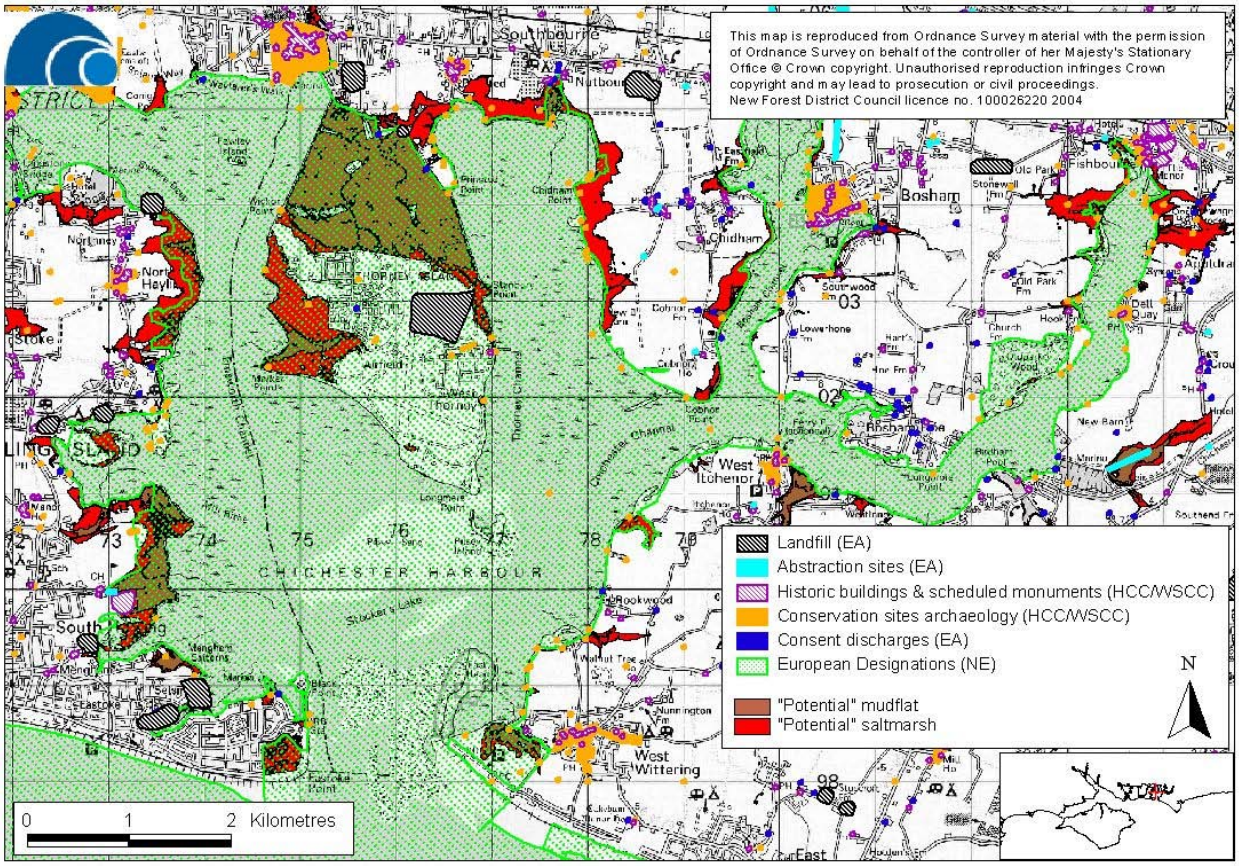


Figure 5.13b: Managed re-alignment constraints available as GIS layers

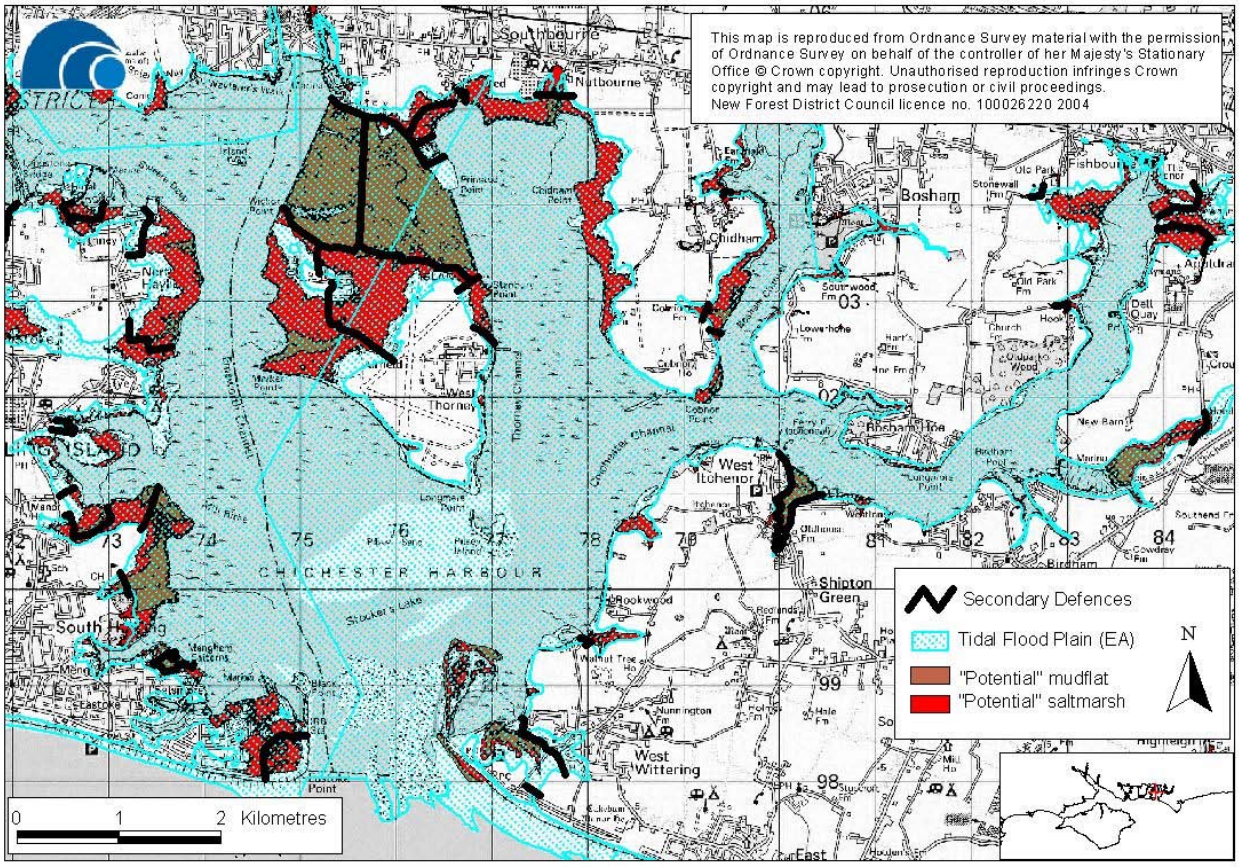


Figure 5.13c: Secondary defences required to protect development from tidal flooding.

Sandy Point, Mengham, Bosham a, Southwood, Fishbourne d and **Westlands** were **factored out** because the sites were too small compared to the potential gain. **Gutner Point** is **naturally occurring**.

The existing defence at the **North Common** (Figure 5.13a) site is maintained by the EA. The site is recommended for **re-alignment** in epoch 0-19. There is the same benefit-cost on the existing route (500 m), compared with the re-aligned route (768 m) because low bunds are recommended. Full re-alignment is proposed for the middle section and RTE for the eastern section which could potentially form a small area of saltmarsh and grazing marsh. The road could remain but will flood occasionally. Flood storage could be built into the new grazing marsh area. The site is non-designated and has the potential to create up to 1.2 ha of inter-tidal habitat under full re-alignment now and 4 ha of inter-tidal habitat in 100 years time.

The existing defence at **Warblington** (Figure 5.13a) is maintained by HBC. The site does not offer a positive benefit-cost for continued management. It is suggested that the residual life of the defence is 0-19 years, therefore the site meets criteria for potential **abandonment** in epoch 0-19 years. The existing line of defence is approximately 370 m in length and any potential secondary defences would be approximately 300 m. The site has the potential to create 3.2 ha of inter-tidal habitat if re-aligned now and 4.8 ha of inter-tidal habitat in 100 years time. NE will allow change to the existing SSSI, therefore replacement habitat is not required.

The existing defence at **Conigar Point** (Figure 5.13a) is maintained by HBC. The site does not offer a positive benefit-cost for continued management. It is suggested that the residual life of the defence is 0-19 years, therefore the site meets criteria for potential **abandonment** in epoch 0-19 years. The existing line of defence is approximately 345 m in length. There is no need for secondary defences because the site naturally rises onto higher ground. The site has the potential to create 2.3 ha of inter-tidal habitat if re-aligned now and 4.1 ha of inter-tidal habitat in 100 years time. The site is non-designated.

The existing defence at **Northney Farm** (Figure 5.13a) is privately maintained. It is suggested that the end of its residual life is 0-19 years. The site does not offer a positive benefit-cost along the existing defence line for public funding, therefore this site meets criteria for potential **abandonment** in epoch 0-19 years. The existing line of defence is approximately 1700 m in length and any potential secondary defences would be approximately 1414 m. The site has the potential to create 27.7 ha of inter-tidal habitat if re-aligned now and 46 ha of inter-tidal habitat in 100 years time. However, part of the site is designated as a SPA. NE would require 26 ha of replacement habitat. There maybe the opportunity for the replacement habitat (grazing marsh) to migrate landwards if the existing defence was abandoned. The site would require flood storage. Any change in management would require agreement from landowners.

The existing defence at **Verner Common a** (Figure 5.13a) is privately maintained. It is suggested that the end of its residual life is 0-19 years. The site does not offer a positive benefit-cost for public funding, therefore this site meets criteria for potential **abandonment** in epoch 0-19 years. The existing line of defence is approximately 1600 m in length and any potential secondary defences would be approximately 504 m. NE will allow change to the existing SPA, therefore replacement habitat is not required. The

site has the potential to create 0.5 ha of inter-tidal habitat if re-aligned now and 6 ha of inter-tidal habitat in 100 years time. Any change in management would require agreement from landowners.

The existing defence at **Verner Common b** (Figure 5.13a) is privately maintained. It is suggested that the end of its residual life is 20-49 years. The site does not offer a positive benefit-cost for public funding, therefore this site meets criteria for potential abandonment in epoch 20-49 years. The existing line of defence is approximately 330 m in length. There is no need for any secondary defences because the site naturally rises onto higher ground. The site has the potential to create 0.2 ha of inter-tidal habitat if re-aligned now and 2.4 ha of inter-tidal habitat in 100 years time. The site is non-designated. Any change in management would require agreement from landowners.

The existing defence at **Pounds Marsh** (Figure 5.13a) is privately maintained. It is suggested that the end of its residual life is 20-49 years. Protection along the existing defence line may not satisfy the economic assessment criteria to attract public funding due to the option of secondary defences providing a higher benefit cost ratio. This will be further considered as part of the North Solent Shoreline Management Plan and the developing coastal defence strategy. This site meets criteria for potential abandonment in epoch 20-49 years according to the assumptions made, because it is privately maintained. However, if there is sufficient benefit-cost, it may be cheaper to hold the existing line (465 m) rather than re-align (1053 m) or abandon. The site has the potential to create 6.3 ha of inter-tidal habitat if re-aligned now and 10.2 ha of inter-tidal habitat in 100 years time. The site is non-designated. Any change in management would require agreement from landowners.

The existing defence at **Tournebury** (Figure 5.13a) is privately maintained. It is important to note that it contains toxic material. It is suggested that the end of its residual life is 20-49 years. The site does not offer a positive benefit-cost for public funding along the current line, therefore this site meets criteria for potential abandonment in epoch 20-49 years. The existing line of defence is approximately 2000 m in length and any potential secondary defences would be approximately 239 m. The site has the potential to create 40 ha of inter-tidal habitat if re-aligned now and 44 ha of inter-tidal habitat in 100 years time. However, the site is designated as a SPA and NE would require 43 ha of replacement habitat. This maybe a good site for the EA to adopt for future re-alignment. Any change in management would require agreement from landowners.

The existing defence at **Selsmore** (Figure 5.13a) is privately maintained. It is suggested that the end of its residual life is 0-19 years. This site meets criteria for potential abandonment in epoch 0-19 years according to the assumptions made, because it is privately maintained. However, there could be sufficient benefit-cost for the EA to adopt the site, in which case it would be cheaper to hold the existing line or RTE (792 m) rather than re-align (927 m). This will be further considered as part of the North Solent Shoreline Management Plan and the developing coastal defence strategy. The site has the potential to create 3.5 ha of inter-tidal habitat if re-aligned now and 3.7 ha of inter-tidal habitat in 100 years time. The site is non-designated. Any change in management would require agreement from landowners.

The existing defence at **Thorney Island a** (Figure 5.13a) is maintained by the MOD. The site does not offer a positive benefit-cost for public funding. It is suggested that the

residual life of the defence is 0-19 years, therefore the site meets criteria for potential **abandonment** in epoch 0-19 years. The existing line of defence is approximately 2662 m in length and any potential secondary defences would be approximately 2056 m. The site has the potential to create 40.1 ha of inter-tidal habitat if re-aligned now and 63.3 ha of inter-tidal habitat in 100 years time. The site is non-designated.

The existing defence at **Thorney Island b** (Figure 5.13a) is maintained by West Sussex County Council on the east side and the EA on the west. It is suggested that the end of its residual life is 0-19 years. The site is recommended for **hold the line** as there is better benefit-cost on the existing route (2245 m) compared with the potential re-alignment route (3890+1348 m for causeway). The site has the potential to create 188 ha of inter-tidal habitat if re-aligned now and 190 ha of inter-tidal habitat in 100 years time if the secondary defence depicted in Figure 3.8 was built. The site is designated as a SPA but would sustain habitat functions under RTE.

The existing defence at **Thorney Island c** (Figure 5.13a) is maintained by the MOD. The site does not offer a positive benefit-cost for public funding. It is suggested that the residual life of the defence is 20-49 years, therefore the site meets criteria for potential **abandonment** in epoch 20-49 years. The existing line of defence is approximately 838 m in length and any potential secondary defences would be approximately 440 m. The site has the potential to create 3.3 ha of inter-tidal habitat if re-aligned now and 6.7 ha of inter-tidal habitat in 100 years time. The site is non-designated.

The existing defence at **Prinstead** (Figure 5.13a) is maintained by an OA. It is suggested that the end of its residual life is 50-99 years. The site is recommended for **hold the line** as there is better benefit-cost on the existing route (425 m) compared with the potential re-alignment route (997 m). The site has the potential to create 7.2 ha of inter-tidal habitat if re-aligned now and 8.6 ha of inter-tidal habitat in 100 years time if the secondary defence depicted in Figure 3.8 was built. The site is non-designated.

The existing defence at **Nutbourne** (Figure 5.13a) is maintained by the EA. The site is recommended for **re-alignment** in epoch 50-99. There is better benefit-cost on the re-aligned route (553 m), compared with the existing route (1590 m). The site has the potential to create up to 16.6 ha of inter-tidal habitat under full re-alignment now and 25.6 ha of inter-tidal habitat in 100 years time. NE will allow change to the existing SPA, therefore replacement habitat is not required.

The existing defence at **West Chidham a+b** (Figure 5.13a) is privately maintained. The site does not offer a positive benefit-cost for public funding along the current line. It is suggested that the end of its residual life is 0-19 years. This site meets criteria for potential **abandonment** in epoch 0-19 years according to the assumptions made, because it is privately maintained. The existing line of defence is approximately 2480 m in length. According to this study, secondary defences would not be required. The site has the potential to create 14.8 ha of inter-tidal habitat if re-aligned now and 37 ha of inter-tidal habitat in 100 years time. NE will allow change to the existing SPA, therefore replacement habitat is not required. This site has been purchased by Associated British Ports and is ready for re-alignment to offset inter-tidal loss from a future damaging scheme. Any change in management would require agreement from landowners.

The existing defence at **East Chidham a** (Figure 5.13a) is privately maintained. The site does not offer a positive benefit-cost for public funding. It is suggested that the end of its residual life is 20-49 years. This site meets criteria for potential **abandonment** in epoch 20-49 years according to the assumptions made, because it is privately maintained. The existing line of defence is approximately 731 m in length. Secondary defences would not be required. The site has the potential to create 3.9 ha of inter-tidal habitat if re-aligned now and 4.7 ha of inter-tidal habitat in 100 years time. The site is non-designated. Any change in management would require agreement from landowners.

The existing defence at **East Chidham b** (Figure 5.13a) is privately maintained. The site does not offer a positive benefit-cost for public funding. It is suggested that the end of its residual life is 0-19 years. This site meets criteria for potential **abandonment** in epoch 0-19 years according to the assumptions made, because it is privately maintained. The existing line of defence is approximately 1666 m in length and any potential secondary defences would be approximately 296 m. The site has the potential to create 2.9 ha of inter-tidal habitat if re-aligned now and 16.6 ha of inter-tidal habitat in 100 years time. The site is non-designated. Any change in management would require agreement from landowners.

The existing defence at **East Chidham c** (Figure 5.13a) is privately maintained. The site does not offer a positive benefit-cost for public funding. It is suggested that the end of its residual life is 20-49 years. This site meets criteria for potential **abandonment** in epoch 20-49 years according to the assumptions made, because it is privately maintained. The existing line of defence is approximately 907 m in length and any potential secondary defences would be approximately 106 m. The site has the potential to create 0.4 ha of inter-tidal habitat if re-aligned now and 4.7 ha of inter-tidal habitat in 100 years time. The site is non-designated. Any change in management would require agreement from landowners.

The existing defence at **Bosham b** (Figure 5.13a) is maintained by the EA. The site does not offer a positive benefit-cost for continued management. It is suggested that the residual life of the defence is 0-19 years, therefore the site meets criteria for potential **abandonment** in epoch 0-19 years. The existing line of defence is approximately 240 m in length. Secondary defences would not be required. The site has the potential to create 1.9 ha of inter-tidal habitat if re-aligned now and 4.8 ha of inter-tidal habitat in 100 years time. The site is non-designated.

The existing defence at **West Wittering** (Figure 5.13a) is maintained by Chichester District Council. The site is recommended for **re-alignment** in epoch 50-99. Benefit-cost is the same on the existing route (1000 m), compared with the re-aligned route (1000 m). The site has the potential to create up to 10.8 ha of inter-tidal habitat under full re-alignment now and 13.6 ha of inter-tidal habitat in 100 years time. NE will allow change to the existing SPA, therefore replacement habitat is not required. Any inter-tidal habitat created will be counted as mitigation.

The existing defence at **Ella Nore** (Figure 5.13a) is privately maintained. The site does not offer a positive benefit-cost for public funding along the current line. It is suggested that the end of its residual life is 0-19 years. This site meets criteria for potential **abandonment** in epoch 0-19 years according to the assumptions made, because it is privately maintained. The existing line of defence is approximately 155 m in length and

any potential secondary defences would be approximately 200 m. The site has the potential to create 3.3 ha of inter-tidal habitat if re-aligned now and 5.1 ha of inter-tidal habitat in 100 years time. The site is non-designated. Any change in management would require agreement from landowners.

The existing defence at **Horse Pond** (Figure 5.13a) is privately maintained. The site does not offer a positive benefit-cost for public funding along the current line. It is suggested that the end of its residual life is 0-19 years. This site meets criteria for potential **abandonment** in epoch 0-19 years according to the assumptions made, because it is privately maintained. The existing line of defence is approximately 300 m in length. Secondary defences would not be required. The site has the potential to create 4.7 ha of inter-tidal habitat if re-aligned now and 5.8 ha of inter-tidal habitat in 100 years time. NE will allow change to the existing SPA, therefore replacement habitat is not required. Any change in management would require agreement from landowners.

The existing defence at **Itchenor** (Figure 5.13a) is privately maintained. The site does not offer a positive benefit-cost for public funding. It is suggested that the end of its residual life is 20-49 years. This site meets criteria for potential **abandonment** in epoch 20-49 years according to the assumptions made, because it is privately maintained. The existing line of defence is approximately 528 m in length and any potential secondary defences would be approximately 2096 m. The site has the potential to create 10.7 ha of inter-tidal habitat if re-aligned now and 11.5 ha of inter-tidal habitat in 100 years time under full re-alignment. There maybe the opportunity for RTE. The site is non-designated. Any change in management would require agreement from landowners.

The existing defence at **Birdham** (Figure 5.13a) is privately maintained. The site does not offer a positive benefit-cost for public funding. It is suggested that the end of its residual life is 100 years plus. This site meets criteria for potential **abandonment** in epoch 100 years plus according to the assumptions made, because it is privately maintained. The existing line of defence is approximately 300 m in length and any potential secondary defences would be approximately 366 m. The site has the potential to create 21.2 ha of inter-tidal habitat if re-aligned now and 25 ha of inter-tidal habitat in 100 years time under full re-alignment. There maybe the opportunity for RTE. The site is non-designated. Any change in management would require agreement from landowners.

The existing defence at **Fishbourne a** (Figure 5.13a) is privately maintained. The site does not offer a positive benefit-cost for public funding. It is suggested that the end of its residual life is 20-49 years. This site meets criteria for potential **abandonment** in epoch 20-49 years according to the assumptions made, because it is privately maintained. The existing line of defence is approximately 1500 m in length and any potential secondary defences would be approximately 200 m. The site has the potential to create 10.9 ha of inter-tidal habitat if re-aligned now and 21.3 ha of inter-tidal habitat in 100 years time. NE will allow change to the existing SPA, therefore replacement habitat is not required. Any change in management would require agreement from landowners.

The existing defence at **Fishbourne b** (Figure 5.13a) is maintained by the EA. It is suggested that the end of its residual life is 20-49 years. The site is recommended for **hold the line** as there is better benefit-cost on the existing route (480 m) compared with the potential re-alignment route (682 m). The site provides adequate benefit-cost

because of the sewerage works. The site has the potential to create 3 ha of inter-tidal habitat if re-aligned now and 9.8 ha of inter-tidal habitat in 100 years time if the secondary defence depicted in Figure 5.16c was built. The site is non-designated.

The existing defence at **Appledram** (Figure 5.13a) is maintained by an OA. It is suggested that the end of its residual life is 20-49 years. The site is recommended for **hold the line** as there is better benefit-cost on the existing route (300 m) compared with the potential re-alignment route (821 m). The site has benefit-cost because of the sewerage works. The site has the potential to create 6.9 ha of inter-tidal habitat if re-aligned now and 10.7 ha of inter-tidal habitat in 100 years time if the secondary defence depicted in Figure 5.16c was built. The site is non-designated.

5.3.12 Pagham Harbour

Potential habitat creation sites (Figure 5.14a), GIS constraints (Figure 5.14b) and requirement for secondary defences (Figure 5.14c) within the Pagham Harbour geographical unit are presented.

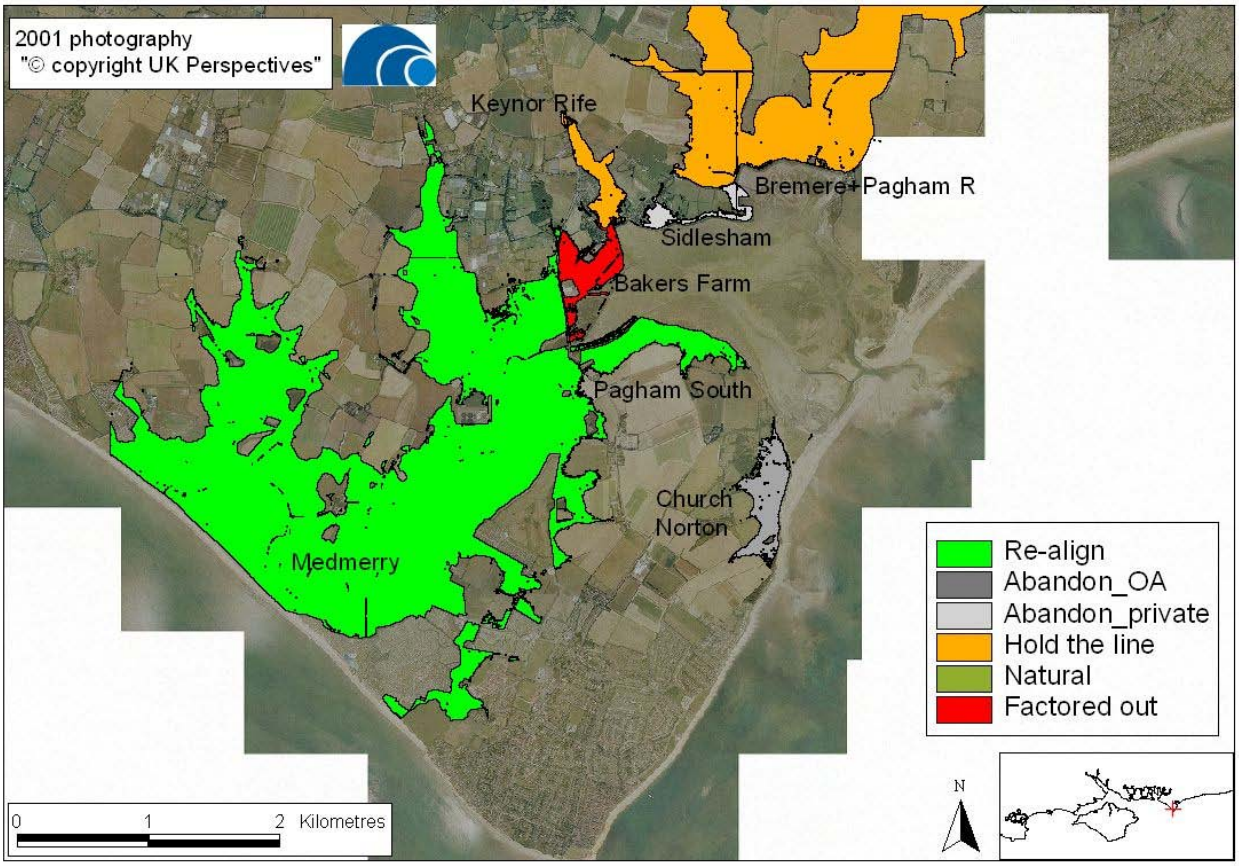


Figure 5.14a: Potential habitat creation sites

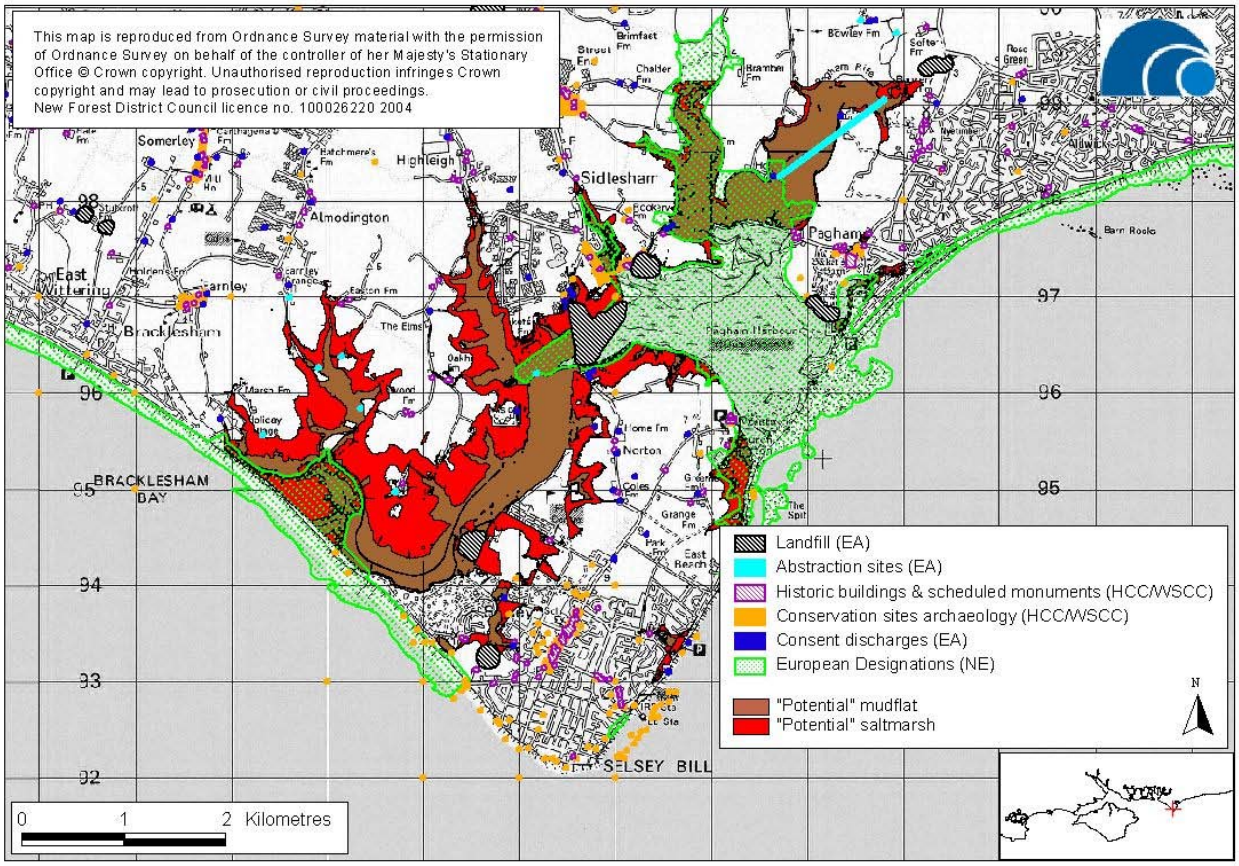


Figure 5.14b: Managed re-alignment constraints available as GIS layers

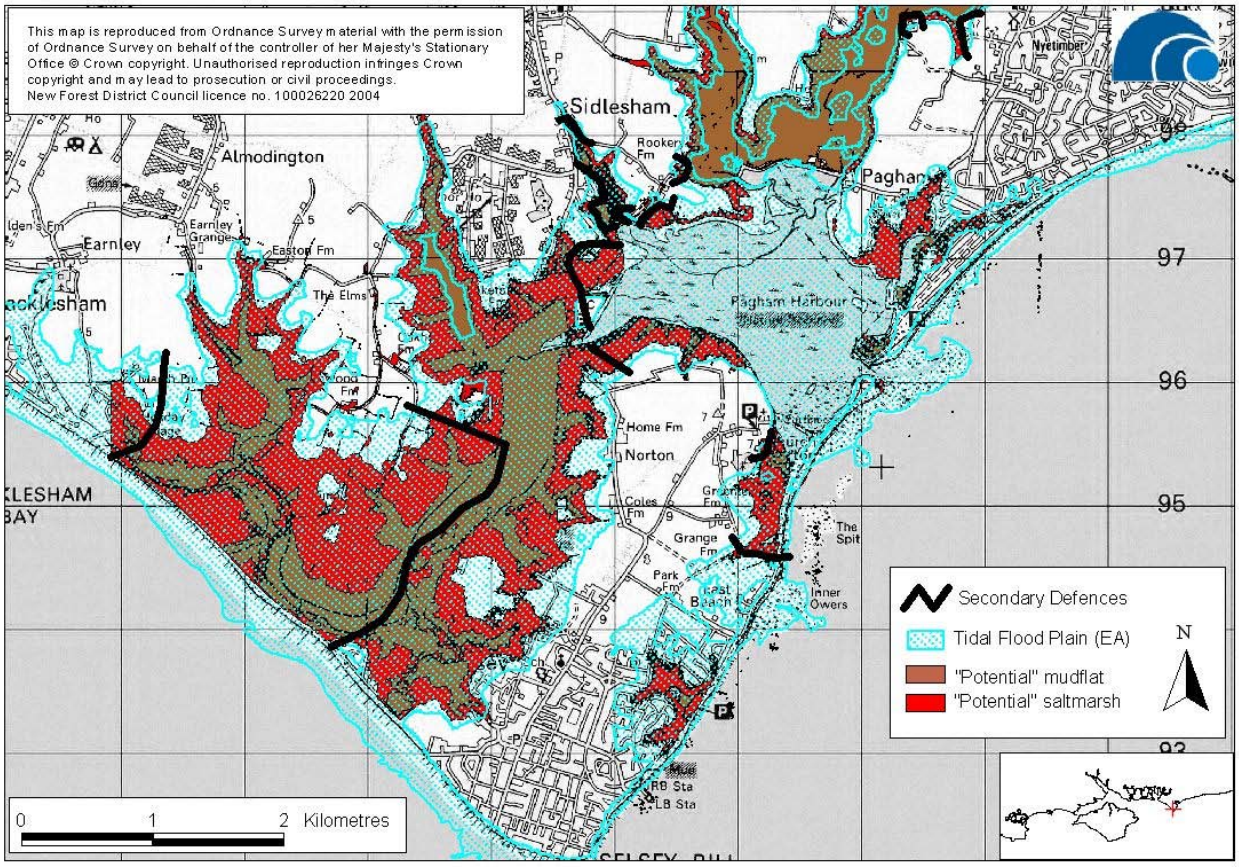


Figure 5.14c: Secondary defences required to protect development from tidal flooding.

Bakers Farm was **factored out** because it is former landfill.

The existing defence at **Medmerry** (Figure 5.14a) is maintained by the EA. The site is recommended for **re-alignment** in epoch 0-19. Benefit-cost is the same on the existing route (4098 m), compared with the re-aligned route (4039 m). The site has the potential to create up to 264 ha of inter-tidal habitat under full re-alignment now and 347 ha of inter-tidal habitat in 100 years time. NE will allow change to the small area of SSSI. Medmerry is the largest potential inter-tidal habitat creation site in the north Solent.

The existing defence at **Pagham South** (Figure 5.14a) is maintained by the EA. The site is recommended for **re-alignment** in epoch 20-49. The existing route would not meet benefit-cost (1500 m) but the shorter, re-aligned route may (365 m). The site has the potential to create up to 15 ha of inter-tidal habitat under full re-alignment now and 22.2 ha of inter-tidal habitat in 100 years time. NE will allow change to the 3 ha of designated SSSI, SPA and RAMSAR.

The existing defence at **Church Norton** (Figure 5.14a) is maintained by the EA and Chichester District Council. The site does not offer a positive benefit-cost for continued management. It is suggested that the residual life of the defence is 0-19 years, therefore the site meets criteria for potential **abandonment** in epoch 0-19 years. The existing line of defence is approximately 1127 m in length compared with the potential re-alignment route (855 m). The site has the potential to create 13.7 ha of inter-tidal habitat if re-aligned now and 21.1 ha of inter-tidal habitat in 100 years time. The site is designated as a SPA. NE assumes the site can maintain its function up to 50 years as the shingle bank migrates over the site. After this, the SPA function will be lost and replacement habitat required.

The existing defence at **Keynor Rife** (Figure 5.14a) is maintained by the EA. The residual life is unknown. The site is recommended for **hold the line** as there is better benefit-cost on the existing route (200 m) compared with the potential re-alignment route (1490 m). In addition, the site is designated as a SPA and would require replacement habitat if it were to be re-aligned. The site has the potential to create 10.5 ha of inter-tidal habitat if re-aligned now and 13.3 ha of inter-tidal habitat in 100 years time if the secondary defence depicted in Figure 5.17c was built.

The existing defence at **Sidlesham** (Figure 5.14a) is privately maintained. The site does not offer a positive benefit-cost for public funding. It is suggested that the end of its residual life is 0-19 years. This site meets criteria for potential **abandonment** in epoch 0-19 years according to the assumptions made, because it is privately maintained. The existing line of defence is approximately 1466 m in length and any potential secondary defences would be approximately 768 m. The site has the potential to create 2.2 ha of inter-tidal habitat if re-aligned now and 8 ha of inter-tidal habitat in 100 years time. The site is non-designated. Any change in management would require agreement from landowners.

The existing defence at **Bremere and Pagham Rife** (Figure 5.14a) is maintained by the EA. It is suggested that the end of its residual life is 20-49 years. The site is recommended for **hold the line** as there is better benefit-cost on the existing route (1050 m) compared with the potential re-alignment route (1254 m). There are also land drainage problems which support holding the line. In addition, 120 ha of the site is

designated as a SPA and would require replacement habitat if it were to be re-aligned. The site has the potential to create 188 ha of inter-tidal habitat if re-aligned now and 196.3 ha of inter-tidal habitat in 100 years time if the secondary defence depicted in Figure 5.14c was built.

Table 5.3 summarises the questionnaire findings on a north Solent-wide basis. It presents the total area that could be created through the three management options for the 54 sites, the area available to offset against future damaging schemes and also the area of replacement freshwater habitat required. This is over 100 year's time.

	Management option			Total (ha)
	Re-align	**Abandon**	**Hold the line**	
Total potential area (ha)	552	686	787	**2025**
Area available to offset future damaging scheme (ha)	552	0	0	**552**
Area of replacement freshwater habitat required (ha)	79	328	0	**407**

Table 5.3: Potential inter-tidal habitat creation across the north Solent over the next 100 years

5.4 Final ranking of potential habitat creation sites

A matrix was applied to rank the sites within each time epoch; this addressed more detailed issues such as land use, proximity of existing saltmarsh, licensed abstraction sites, historic buildings/scheduled monuments, archaeology, land ownership, rights of way and recreational use (see Appendix 2).

Sites were ranked in each epoch and within their potential management option (i.e. – managed re-alignment, OA abandon, private abandon and hold the line), using the matrix (Table 5.4). Sites located at the top of epochs 0-19, 20-49, 50-100 and 100+ are technically most favourable for re-alignment or abandonment as;

- the land use is either unused or low grade agricultural land
- there is no or little cultural heritage
- there are no or few licensed abstraction sites
- there is low recreational usage
- there are no rights of way
- the land is owned by one statutory body rather than a number of individual private landowners
- the site is greater than 10 ha in area. Those sites greater than 40 ha were weighted.

0-19	Ha	Score	20-49	Ha	Score	50-99	Ha	Score	100+	Ha	Score	Hold the line	Ha	Score	Naturally occurring	Factored out
West Northney	7	29	Pagham South	22.2	29	Stoke	4.6	28	Birdham	25	30	Southmoor	13.9	29	Beaulieu River_a	Alexandra Park
Medmerry	347	27	Thorney Island_c	11.9	24	Nutbourne	25.6	26				Prinstead	8.6	28	Beaulieu River_b	Alverstoke
Gillies	2.2	27	Itchenor	11.5	31	West Wittering	13.6	25				Appledram	10.7	27	Chaldock Point	Anchorage
Farlington Marshes	74	27	Tournerbury	44	29							Bremere and Pag Rife	196	27	Darkwater	Bakers Farm
North Common	4	26	Verner Common_b	2.4	28							Portchester Rec	8.1	26	Gutner Point	Bosham_a
Saltgrass Lane	15.9	24	Pounds Marsh	10.2	27							Fishbourne_b	9.8	26	Hamble_a	Bury Marshes
Lymington Reedbeds	35.6	24	Warren_Nore_b	44.3	27							Thorney Island_b	190	25	Hamble_b	Calshot
Conigar Point	4.1	30	Fishbourne_a	21.3	27							Keynor Rife	13.3	24	Hamble_c	Cams Hall A
Hook Lake	46	29	Beaulieu_Warren	193	27							Titchfield	170	23	Test Valley	Cams Hall B
Bosham_b	4.8	28	Warren_Nore_a	12.3	26							Key_Pen_b	101	23		Cams Hall D
Wicor	1	28	Newtown	1.6	25							Avon Water	40.7	23		Eastney
Thorney Island_a	63.3	28	East Chidham_a	4.7	24							Key_Pen_a	24	21		Fishbourne_d
Warblington	4.8	27														Fleetlands
Fleet	2.3	26														Frater
Church Norton	21.1	21														Gilkicker
Northney Farm	46	28														Great Salterns
Ella Nore	5.1	27														Hilsea
West Chidham_a+b	37	27														Horsea Island
Stanswood Valley	13.7	27														Hythe_b
Verner Common_a	6	26														Itchen Valley
Horse Pond	5.8	25														Lower Lym_b
Stansore Point	15.4	25														Lower Lym_c
Sidlesham	8	25														Lower Lym_d
East Chidham_c	4.7	24														Mengham
East Chidham_b	16.6	23														Pitts Deep
Selsmore	3.7	23														Plummers Water
																Ports Creek
																River Alver
																Salterns
																Sandy Point
																Sinah
																Sowley_a
																Sowley_b
																Westlands
																Woodcot

Re-align (OA)
Abandon (private)
Abandon (OA)
Hold the line (OA)
Naturally occurring
Factored out

Table 5.4: Epoch and ranking of potential habitat creation sites

Following this approach across the north Solent, in summary there are:

- 11 potential re-alignment sites covering an area of 552 ha
- 31 potential abandonment sites covering an area of 686 ha
- 12 sites identified as hold the line covering an area of 787 ha

The 11 potential re-alignment sites that could be used to offset damaging schemes (552 ha) (Table 5.4) are,

1. West Northney
2. Medmerry
3. Gillies
4. Farlington Marshes
5. North Common
6. Saltgrass Lane
7. Lymington Reedbeds
8. Pagham South
9. Stoke
10. Nutbourne
11. West Wittering

The 552 ha available for mitigation and compensation to offset inter-tidal squeeze was considerably less than the total potential re-alignment and abandonment options (1238 ha) (Table 5.3).

6 Balancing inter-tidal loss with potential habitat creation sites

6.1 Geographical pattern of sites

The spatial distribution across the north Solent of the questionnaire findings is presented in Figure 6.1. Ideally coastal squeeze should be offset as close to the location of habitat loss as possible (McMullon and Collins, 2003), and efforts should be made to mitigate for habitat losses within each European designated site. Where a potential habitat creation site falls within an SPA, the area is classed as mitigation for coastal squeeze, as opposed to compensation, if found outside the SPA. The balance of coastal squeeze versus potential mitigation / compensation in each SPA (Figure 1.6) is clarified in Table 6.1. The potential mitigation and compensation values are taken from the 552 ha of potential re-alignment sites only. Coastal squeeze was estimated over 100 years assuming maintenance of all existing sea defences causing coastal squeeze (Section 4.5).

SPA	SQUEEZE (ha)	POTENTIAL GAIN (ha)		Deficit (ha)
		Mitigation (inside SPA)	Compensation (outside SPA)	
Solent and Southampton Water (SPA)	136 - 163	41	11	83 - 112
Portsmouth (SPA)	172 - 206	0	2	170 - 204
Langstone and Chichester (SPA)	195 - 231	92	37	66 - 102
Pagham (SPA)	0	2	367	-369
Total: north Solent range	**500 - 600**	**135**	**417**	**-52 - 48**

Table 6.1: Coastal squeeze versus potential mitigation/compensation within each SPA

Table 6.1 shows that the SPAs in the north Solent (excluding Pagham Harbour), cannot provide enough mitigation to offset the inter-tidal coastal squeeze which results from the current defence configuration. Even when adjacent compensation sites are included, there is a deficit in all SPAs apart from Pagham Harbour. Pagham is an exception because not only is there no inter-tidal coastal squeeze predicted over the next 100 years but there is huge compensation potential from the Medmerry and Pagham South sites (Table 5.4). The compensation sites from the Pagham Harbour SPA (367 ha) have the potential to offset coastal squeeze elsewhere in the Solent. However, funding mechanisms may be complicated when re-aligning sites that are not directly linked to a damaging scheme.

The findings support the need for a coherent Solent-wide approach to offsetting inter-tidal coastal squeeze on a region wide basis.

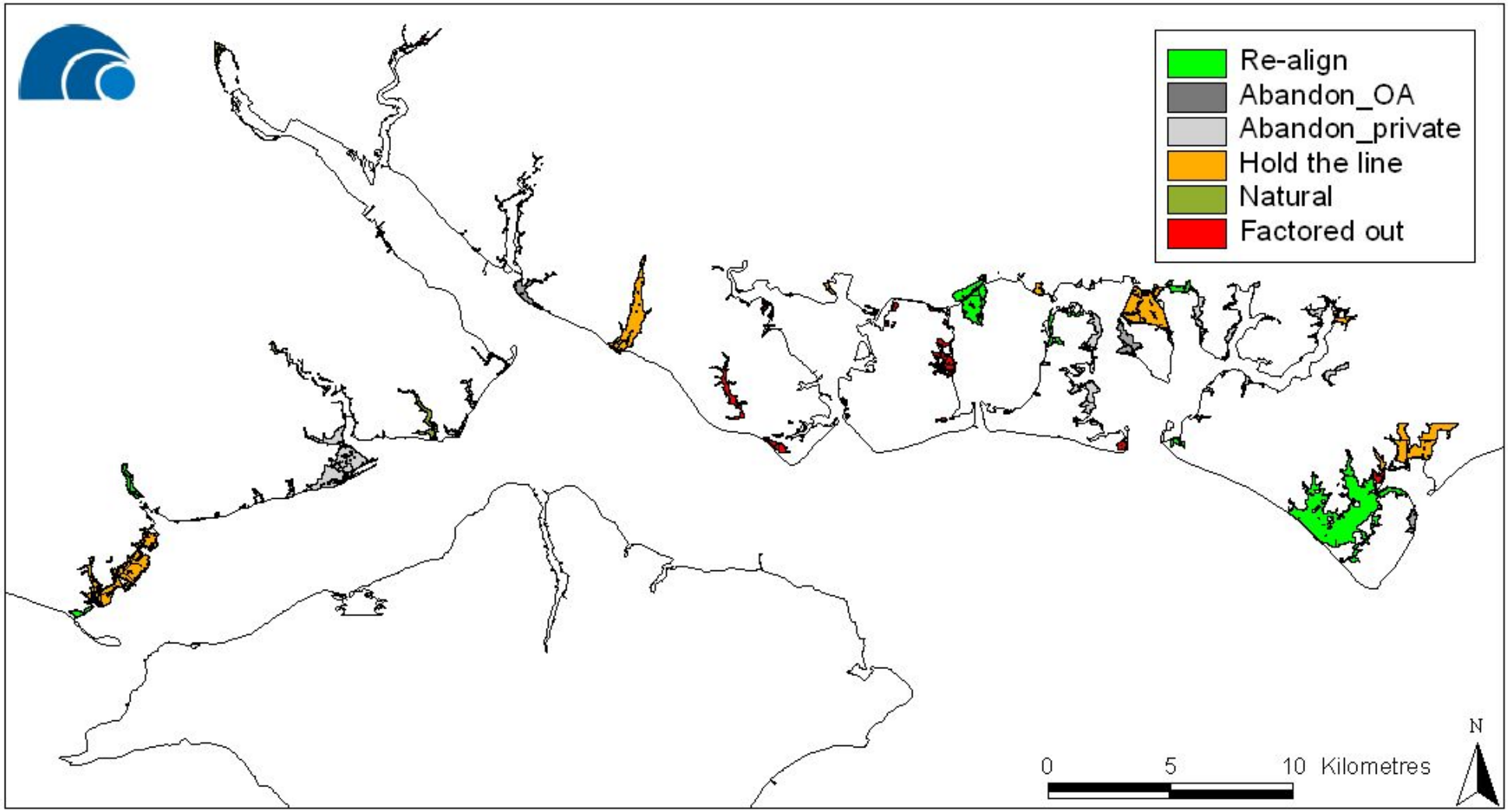


Figure 6.1: Overall north Solent management options

6.2 Balance of gains and losses through time

A suggested timeline for all potential habitat creation sites (2025 ha) is shown in Figure 6.2, using the assumptions made in this study. Potential managed re-alignment sites are balanced against the predicted inter-tidal coastal squeeze throughout the epochs. The coastal squeeze target therefore reduces from approximately 600 ha to 97 ha throughout time, as the potential managed re-alignment sites (552 ha) are gradually implemented (Figure 6.2). Even though abandonment sites cannot currently be used for mitigation or compensation, the defences will no longer cause coastal squeeze, thus the coastal squeeze target could reduce further than shown in Figure 6.2 (Cope *et al.,* 2007b).

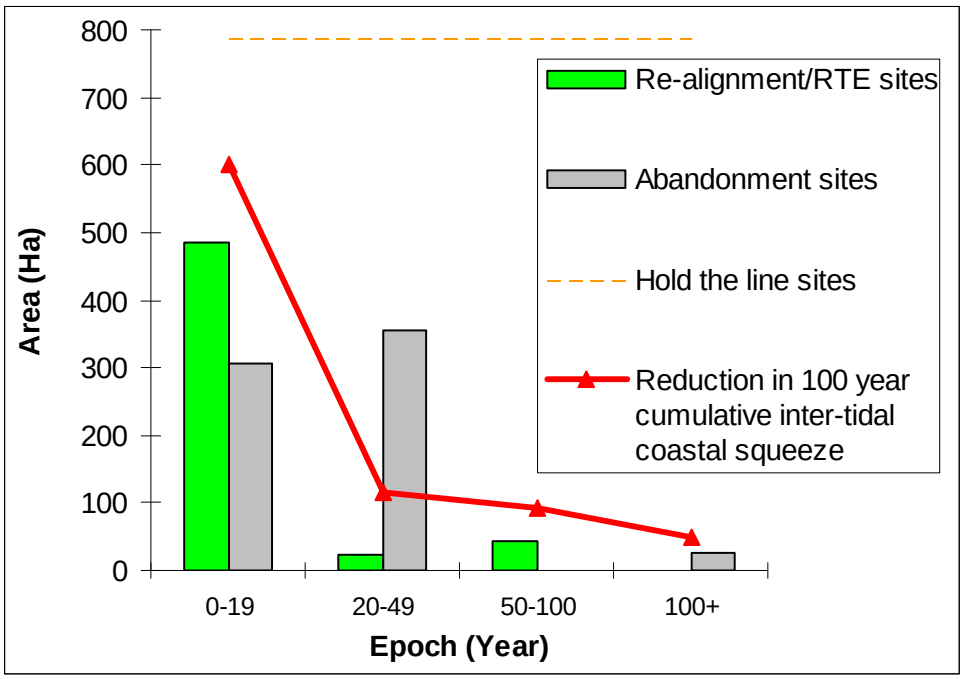


Figure 6.2: Epoch in which potential inter-tidal habitat creation sites may come online

The majority of sites fall into the 0-19 epoch when the defences come to the end of their residual life (Figure 6.2). The overall near balance of potential managed re-alignment gains and coastal squeeze losses, plus the early peak, is very much dependent upon the Medmerry site. Without this one potential re-alignment site, the north Solent will fall short of some 347 ha out of 500-600 ha required. The EA could seek to adopt some of the sites categorised as hold the line or abandonment to offset this shortfall. Those sites that do not require secondary defences and are non-designated should be addressed first.

6.3 Replacement freshwater habitat

All defences currently protecting designated Natura 2000 sites come to the end of their residual life within 50 years and are not 'sustainable' to defend beyond that time. Re-aligning or abandoning a defence over landward designations results in a requirement for 79 ha and 328 ha respectively, of replacement freshwater habitat (Table 5.3). The creation of this habitat is a legal requirement for OAs. Based on the estimate that it can take 50 years to re-create freshwater habitat, replacement needs to start now, in epoch 0-19.

7 Conclusions and recommendations

Key findings from the Solent Dynamic Coast Project are summarized in Table 7.1.

Key findings	Length/Area
Length of north Solent coastline	314 km
Length of north Solent defences	283 km
Mudflat area now	5549-6311 ha (CHaMP, 2003)
Saltmarsh area now	1042 ha
Total inter-tidal habitat loss over next 100 years	752 ha
Coastal squeeze requiring replacement inter-tidal habitat over next 100 years	**500 - 600 ha**
Overall potential inter-tidal gain under natural evolution over next 100 years	3883 ha (100 sites)
Sites of potential inter-tidal gain taken forward for further analysis	2025 ha (54 sites)
Sites identified for potential inter-tidal re-alignment	552 ha
Sites identified for potential inter-tidal abandonment	686 ha
Sites identified as potential hold the line	787 ha
Area of potential re-alignment sites that can be used as inter-tidal mitigation/compensation	**552 ha**
Area of freshwater habitat requiring replacement from potential inter-tidal re-alignment sites	79 ha
Area of freshwater habitat requiring replacement from potential inter-tidal abandonment sites	328 ha

Table 7.1: Key findings from the Solent Dynamic Coast Project (north Solent)

The following key findings arose from this study:

1 More than 50% of the flood defences in front of all potential habitat creation sites (re-alignment, abandonment and hold the line) in the north Solent will reach the end of their residual life in the next 20 years and a further 30% in the next 50 years.

2 Coastal squeeze requiring replacement inter-tidal habitat (500-600 ha) assumed all current defences will be maintained. This is a worse case scenario. Where defences are identified for managed re-alignment or abandonment in the North Solent SMP, they will no longer be contributing to coastal squeeze, thus the coastal squeeze target could reduce.

3 11 sites were identified for potential managed re-alignment (552 ha) over the course of the next 100 years, which are all likely to have adequate benefit-cost at the time of re-build.

4 The 11 key sites to focus on for managed re-alignment, in order of ranking are as follows; West Northney, Medmerry, Gillies, Farlington Marshes, North Common, Saltgrass Lane, Lymington Reedbeds, Pagham South, Stoke, Nutbourne, and West Wittering (Table 5.4).

5 It will not be possible to balance habitat gains and losses within each Natura 2000 site apart from the Pagham Harbour SPA. A balance across a 'north Solent' scale is the most appropriate.

6 The near-balance of inter-tidal loss and gain across the north Solent is only achievable because of the huge potential habitat creation at Medmerry, potentially contributing around 50% of the 500 – 600 ha required.

7 Based on the assumptions of this study, the north Solent would fall short of around 347 ha of compensation land without the Medmerry site.

8 Recent national guidance has suggested that in the future, inter-tidal habitat created through abandonment could, not only be used to offset the BAP target and help achieve the SSSI target but could mitigate or compensate for coastal squeeze under the Habitat Regulations. This study did not account for this.

9 OAs could seek to adopt some of the sites categorised as hold the line or abandonment to offset any shortfall. Those sites that do not require secondary defences and are non-designated should be addressed first.

10 This study indicates that potential changes to management practice will result in a legal requirement to replace 407 ha of freshwater habitat. 79 ha are from potential re-alignment sites and form a necessary element of the suggested approach to offset coastal squeeze in the Solent. 16 ha are from potential OA abandonment sites and 311 ha are from potential private abandonment sites. This requirement will not be an obligation for private landowners.

11 The cost of creating and maintaining new, designated freshwater habitat where existing habitat is subject to adverse effect from managed re-alignment requires much greater scrutiny within the SMP process. It is possible that the high cost of such a requirement could significantly alter the pattern of suggested managed re-alignments described in this study.

12 It can take up to 50 years to re-create designated freshwater habitat currently existing behind our seawalls. The fact that most of these sea walls may fail within 50 years puts this habitat at high risk in the Solent.

13 A substantial proportion (over 60 %) of the defences fronting potential habitat creation sites are managed by private landowners.

14 The HPI and LiDAR and tidal elevation interpretation are complementary tools for assessing historical inter-tidal trends and future change. In addition, the LiDAR and tidal elevation interpretation was a good technique for identifying potential inter-tidal habitat creation areas.

15 A sensitivity analysis will be required for the North Solent SMP in line with new Government guidance on sea level rise, because the old guidance for 6mm per annum guidance was applied in this investigation.

16 The interview procedure with the local coastal managers provided a valuable collaborative exercise between LAs, the EA, NE, County Councils and Harbour Authorities.

The SDCP project assigned sites to epochs on a site by site assessment to form a strategic approach to offsetting inter-tidal coastal squeeze. The potential managed re-alignment sites (552 ha) maybe politically controversial, particularly with landowners and may not be fully realised until a much later date, if at all. Further investigation and discussion is required prior to re-alignment of these sites. Implications on the geomorphology and hydro-dynamics of estuaries and harbours will have to be considered.

Unless abandonment sites can be used for mitigation or compensation, or additional funding is found to re-align sites that are hold the line, then there could be a shortfall of inter-tidal habitat creation in the north Solent. This is likely to be a particular problem, especially if certain sites identified for re-alignment are not implemented.

Findings from the SDCP and detail on individual potential sites will feed into the North Solent SMP. The SMP will decide whether sites are hold the line, managed re-alignment or abandonment (termed “No Active Intervention” in SMP), and will test this with full public consultation. The SMP will therefore confirm the actual coastal squeeze losses. It is valuable to have a unified approach to offsetting coastal squeeze across not only the north Solent but the Isle of Wight also and between all OAs. The EA southern RHCP will be the vehicle for delivery. Findings from the SDCP and Isle of Wight Mitigation Study will feed into the RHCP.

Aside from the SMP process, this study has highlighted the top 7 sites in the first epoch that require feasibility studies for realignment. The EA is currently trying to obtain funding to start these studies urgently.

It is important to recognise that this project has raised the administrative and political complexities of the Solent with national experts for the first time. As a consequence, the EA RHCP are involving LAs for the first time.

The work has been undertaken by the key statutory authorities. However, this study has not involved any decision making on the part of any statutory authority. The options suggested in this study are there to facilitate future debate and decision making as part of the SMP process. No landowners or wider stakeholders have been consulted as part of the project. These views will be sought as part of the SMP process. The SMP process will integrate all aspects of sustainable development, social, economic as well as environmental, prior to any final decisions on coastal management being made.

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http 2: http://www.ukbap.org.uk/GenPageText.aspx?id=98

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Glossary of terms

Accretion	Accumulation of sand, mud follicles or other beach material due to the natural action of waves, currents, wind and tide
Abandonment site (No Active Intervention)	Refers to potential habitat creation sites where there is no benefit-cost on the existing or re-aligned defence
Biodiversity Action Plan	A national action plan for a key habitat or species, approved by Government, as part of the overall UK Biodiversity Action Plan
Coastal Defence	The general term applied to coast protection and sea defence
Coastal Grazing Marsh	Periodically inundated pasture, or meadow with ditches which maintain the water levels, containing standing brackish or fresh water
Coastal Squeeze	Where a sea defence inhibits landward migration of designated inter-tidal habitat
Compensation	To offset coastal squeeze outside a European designation
CHaMP	A non-statutory management plan which identifies potential future changes to coastal habitats and potential compensation measures for any losses to a European designated site or group of sites
Edge erosion	The loss of saltmarsh on the outer edge of the marsh, possibly as a result of wave attack.
Erosion	The loss of land or encroachment by the sea through a combination of natural forces e.g. wave attack, slope processes, high groundwater levels
“Existing” mudflat/saltmarsh	Areas of established inter-tidal habitat. Often in front of a hard defence or rising ground
Floodplain	The low relief area adjacent to a river or the sea that is periodically inundated by floodwater
Geomorphology	The study of landforms and land forming processes
Habitat	The environment of an organism and the place where it is usually found
Hold the line	Maintain or upgrade level of protection provided by defences

Internal dissection	The loss of saltmarsh as a result of waterlogging and salt pan formation in hollows
Inter-tidal	Area between Lowest Astronomical Tide (LAT) and Highest Astronomical Tide (HAT)
Managed Realignment	Also referred to as **Managed Retreat**, is the setting back of coastal defences to achieve environmental, economic and/or engineering benefits. This process is usually undertaken in low lying estuarine areas to combat coastal squeeze
Mitigation	To offset coastal squeeze within a European designation
Mudflat	An area of fine sediments that is inundated at high tide but exposed at low tide
No Active Intervention	Not to invest in providing or maintaining defences
Operating Authority	The Environment Agency and Local Authorities
“Potential” mudflat/saltmarsh	Areas with the correct topography, in relation to tide, for mudflat or saltmarsh formation. Often behind a hard defence or barrier beach
Regulated Tidal Exchange	Regulated exchange of sea water to an area behind fixed sea defences through engineered structures such as sluices, pipes or tidal gates to create inter-tidal habitat
Saltmarsh	Saline tolerant vegetation which establishes and grows within the inter-tidal area
Sea Defence	Construction engineered to reduce or prevent flooding by the sea
Sea level rise	General term given to the upward trend in mean sea level resulting from global climate change
Topography	The arrangement of the natural and artificial physical features of an area

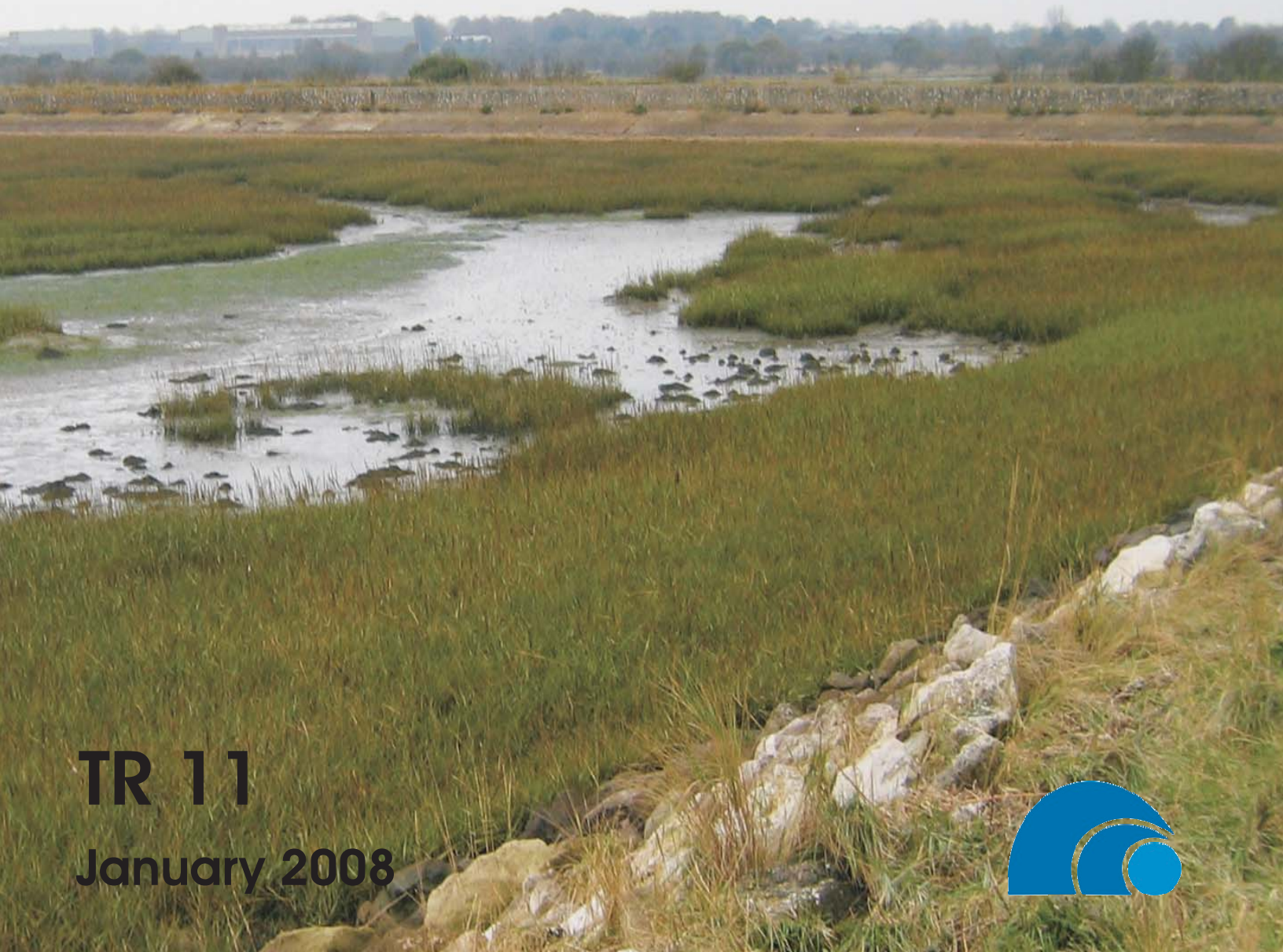
List of abbreviations

AA	Appropriate Assessment
BAP	Biodiversity Action Plans
OA	Operating Authority
CCO	Channel Coastal Observatory
CDS	Coastal Defence Strategy
CHaMP	Coastal Habitat Management Plan
CRoW	Countryside and Rights of Way
DEFRA	Department for Environment and Rural Affairs
EA	Environment Agency
EN	English Nature
EU	European Union
GIS	Geographical Information System
HAT	Highest Astronomical Tide
HPI	Historical Photography Interpretation
LA	Local Authority
LiDAR	Light Detection and Ranging
LAT	Lowest Astronomical Tide
LTEI	LiDAR and Tidal Elevation Interpretation
MHWN	Mean High Water Neaps
MLWS	Mean Low Water Springs
NFDC	New Forest District Council
RHCP	Regional Habitat Creation Programme
RTE	Regulated Tidal Exchange
SAC	Special Area of Conservation
SDCP	Solent Dynamic Coast Project
SINC	Site of Importance for Nature Conservation
SMP	Shoreline Management Plan
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest

Channel Coastal Observatory

SOLENT DYNAMIC COAST PROJECT

Appendix 1

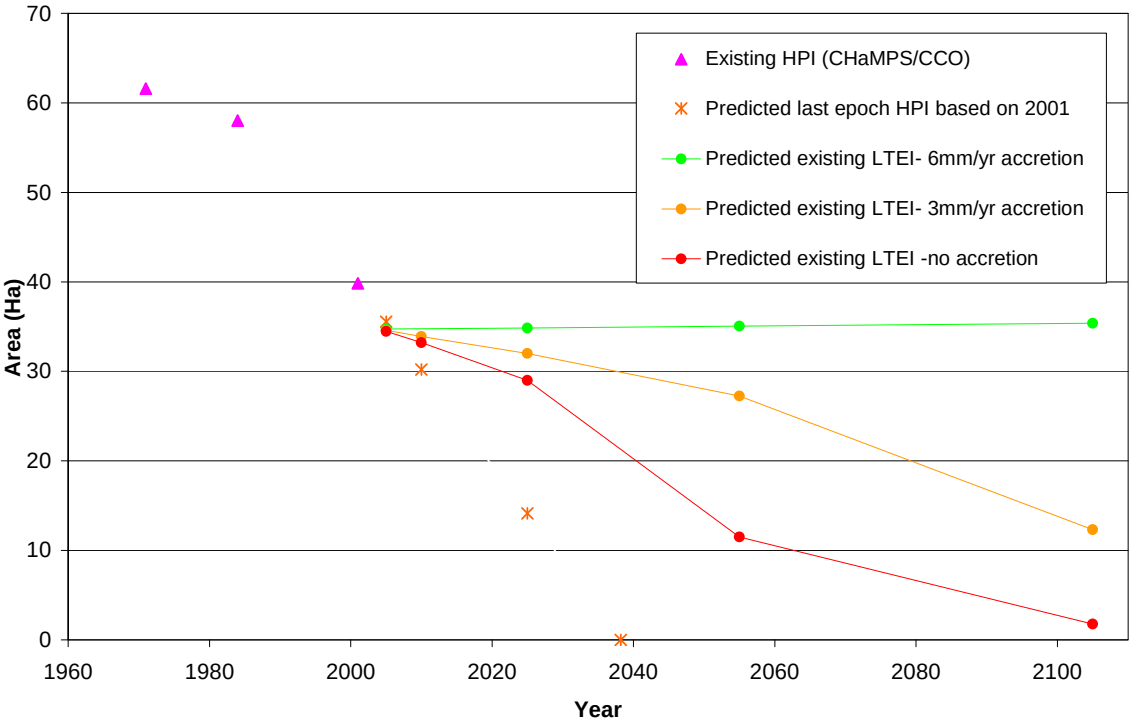


TR 11

January 2008

1.1 Hurst Spit

Results from the LTEI are compared with the HPI prediction in Graph 1; these show projections for saltmarsh area based on existing management.



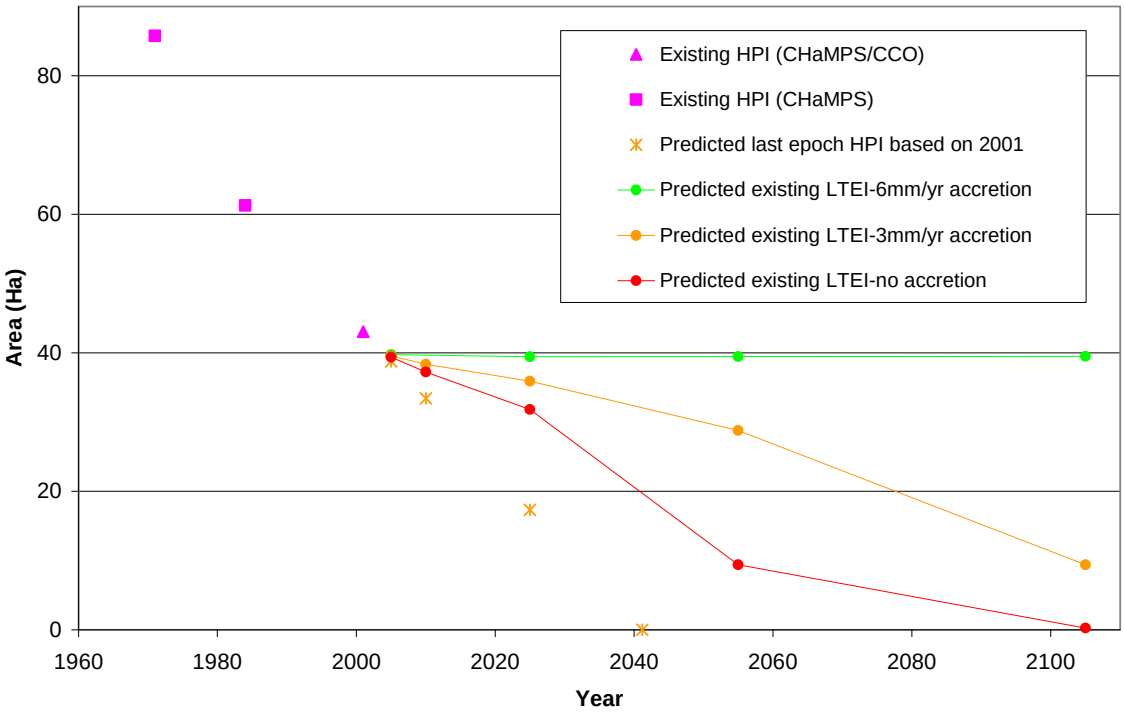
Graph 1: "Existing" saltmarsh prediction at Hurst (comparison of HPI and LTEI)

Graph 4.1a in the main report, shows that the historical rate of saltmarsh loss, determined from HPI, has increased in the last 20 years. There is therefore a high degree of error between the best and worst case extrapolations, reducing the degree of certainty in the prediction.

Based on the rate of loss for the "last epoch" HPI prediction, the "no accretion" LTEI scenario fits best (Graph 1). Still, the HPI is predicting much worse saltmarsh loss for the future compared with the LTEI. Given the rate of sea level rise used for the LTEI scenarios (6mm per annum), it is surprising that the three predictions (particularly "no accretion") are not showing a steeper rate of saltmarsh loss compared with the HPI (Graph 4.3d). Based on the fact the LTEI only accounts for topography and tide, it would appear that local factors must be playing a major role in saltmarsh loss, such as sea level rise and *Spartina* dieback. If these local factors continue in the future then the LTEI prediction maybe optimistic. Results show that saltmarsh at Hurst will be non-existent by 2040 based on current rates of loss derived from HPI and by 2105 based on the relationship between topography and tide (Graph 1).

1.2 Keyhaven

Results from the LTEI are compared with the HPI prediction in Graph 2; these show projections for saltmarsh area based on existing management.



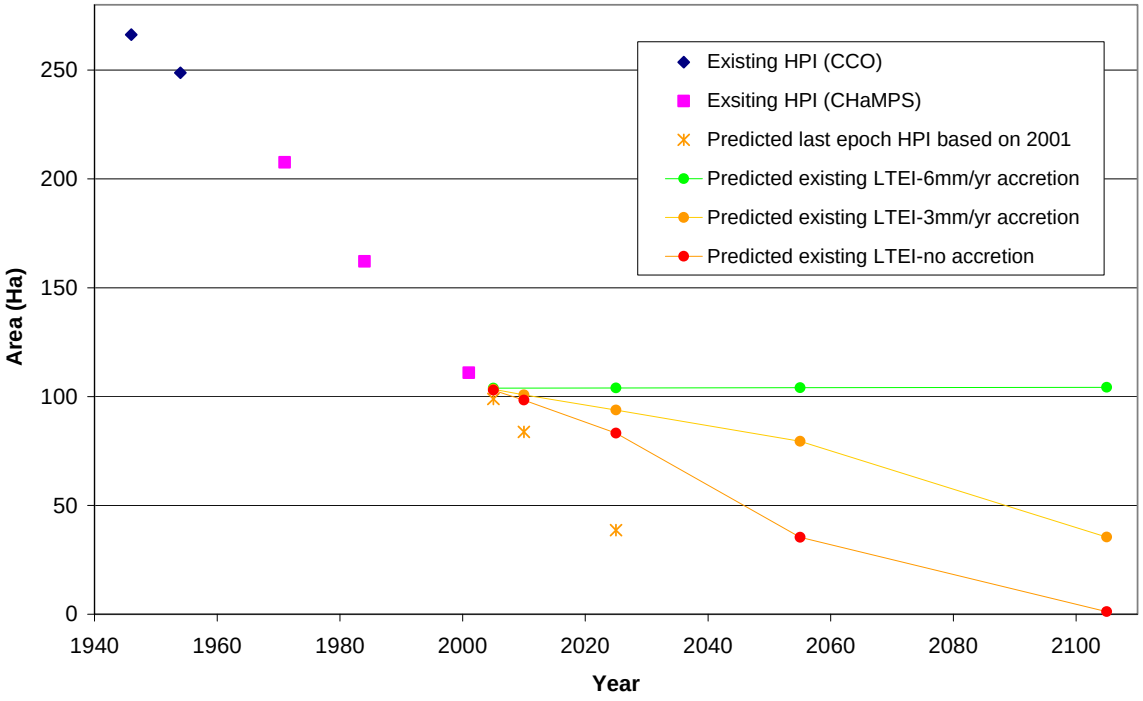
Graph 2: "Existing" saltmarsh prediction at Keyhaven (comparison of HPI and LTEI)

Graph 4.2a in the main report, shows that the historical rate of saltmarsh loss determined from HPI is linear, thereby reducing the degree of uncertainty in the prediction.

Based on the rate of loss for the "last epoch" HPI prediction, the "no accretion" LTEI scenario fits best for Graph 2. Still, the HPI is predicting much worse saltmarsh loss for the future compared with the LTEI. Given the rate of sea level rise used for the LTEI scenarios (6mm per annum), this is surprising. Still, the HPI prediction appears fairly reliable (Graph 4.2a in the main report), therefore local factors must be playing a major role in saltmarsh loss (such as wave attack, *Spartina* dieback, and possibly pollution), rather than a straight relationship between topography and tide. If these local factors continue in the future then the LTEI prediction maybe optimistic. Results show that saltmarsh at Keyhaven will be non-existent by 2040 based on current rates of loss derived from HPI and by 2105 based on the relationship between topography and tide (Graph 2).

1.3 Lymington

Results from the LTEI are compared with the HPI prediction in Graph 3; these show projections for saltmarsh area based on existing management.



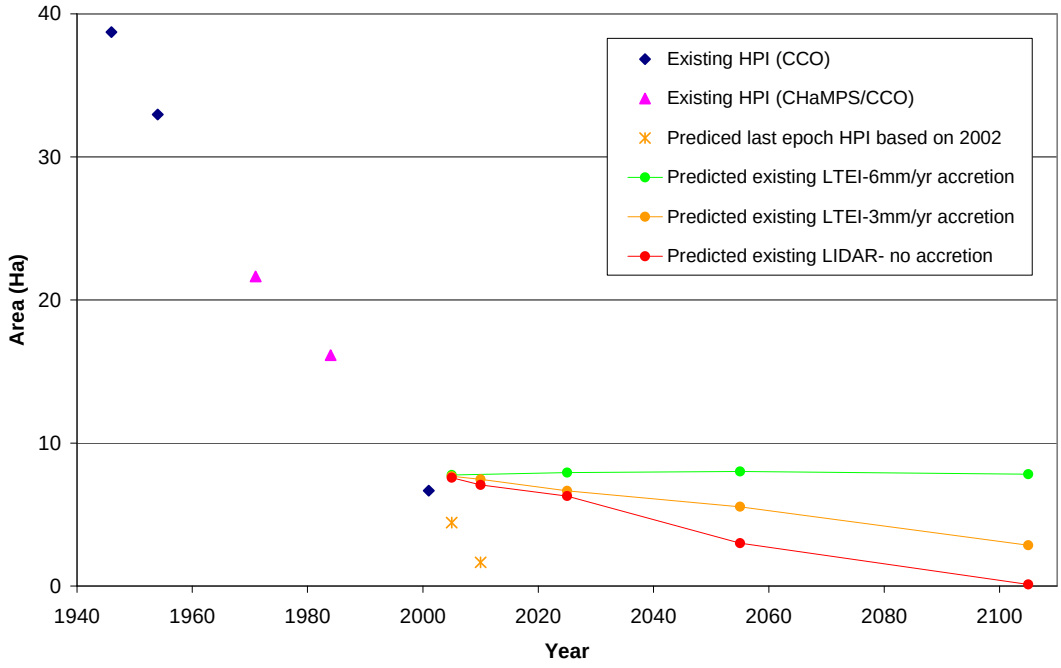
Graph 3: "Existing" saltmarsh prediction in Lymington Harbour (comparison of HPI and LTEI)

Graph 4.3a in the main report, shows that the historical rate of saltmarsh loss determined from HPI is linear, thereby reducing the degree of uncertainty in the prediction.

Based on Graph 4.3d, the best matched LTEI scenario is "no accretion." Still, the HPI is predicting much worse saltmarsh loss for the future compared with the LTEI. Given the rate of sea level rise used for the LTEI scenarios (6mm per annum), this is surprising (Graph 3). The HPI prediction appears fairly reliable, therefore it can be deduced that local factors must be playing a major role in saltmarsh loss (such as wave attack, dredging, *Spartina* dieback, and possibly pollution), rather than a straight relationship between topography and tide. If these local factors continue in the future then the LTEI prediction maybe optimistic. Results show that saltmarsh at Lymington will be non-existent by 2040 based on current rates of loss derived from HPI and by 2105 based on the relationship between topography and tide (Graph 3).

1.4 Pitts Deep and Sowley

Results from the LTEI are compared with the HPI prediction in Graph 4; these show projections for saltmarsh area based on existing management.



Graph 4: "Existing" saltmarsh prediction in Pitts Deep and Sowley (comparison of HPI and LTEI)

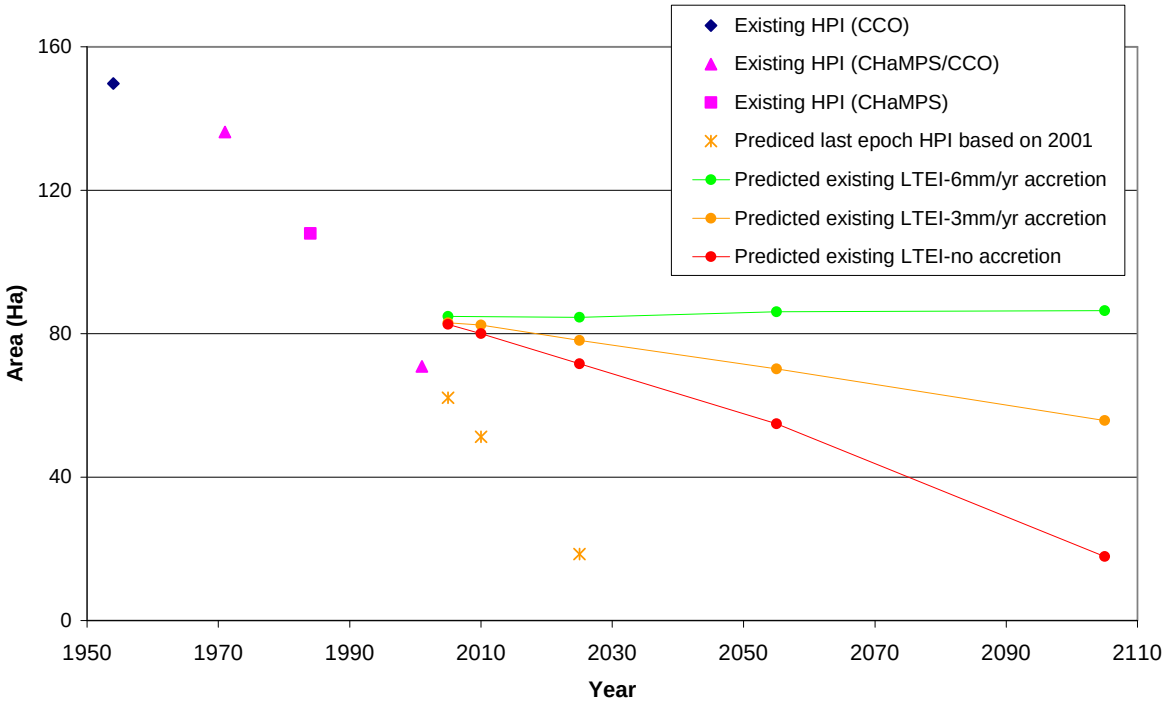
Graph 4.4a in the main report, shows that the historical rate of saltmarsh loss determined from HPI is linear, thereby reducing the degree of uncertainty in the prediction.

Based on Graph 4, the best matched topographic prediction is "no accretion." Still, the HPI is predicting much worse saltmarsh loss for the future compared with the LTEI. Given the rate of sea level rise used for the LTEI scenarios (6mm per annum), this is surprising. The HPI prediction appears fairly reliable, therefore it can be deduced that local factors must be playing a major role in saltmarsh loss (such as wave attack, *Spartina* dieback, and possibly pollution), rather than a straight relationship between topography and tide. If these local factors continue in the future then the LTEI prediction maybe optimistic. Results show that saltmarsh will be non-existent by 2015 based on current rates of loss derived from HPI and by 2105 based on the relationship between topography and tide (Graph 4).

Pitts Deep and Sowley were analysed together. However, through time, the Pitts Deep marsh will probably decrease further, whilst the Sowley marsh will continue to increase in area. Therefore, the predictions in Graphs 4, showing saltmarsh extinction may be the case for Pitts Deep but not for Sowley.

1.5 Beaulieu

Results from the LTEI are compared with the HPI prediction in Graph 5; these show projections for saltmarsh area based on existing management.



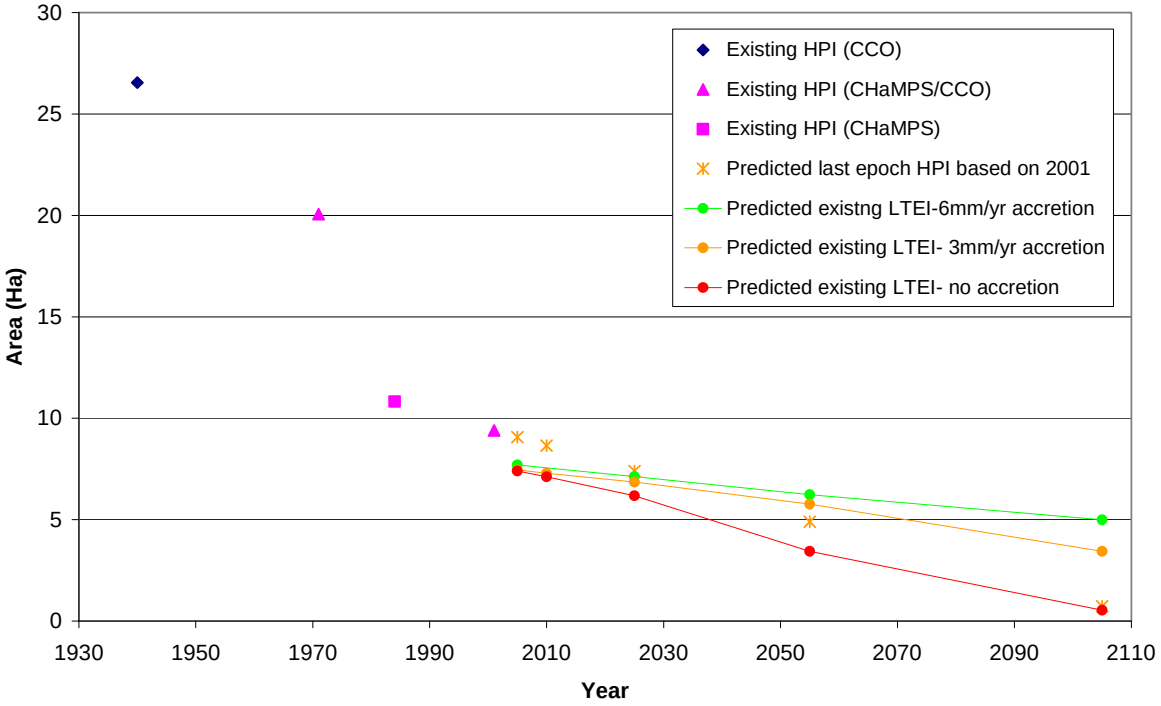
Graph 5: "Existing" and "potential" predicted saltmarsh extent at Beaulieu (comparison of HPI and LTEI)

Graph 4.5a in the main report, shows that the historical rate of saltmarsh loss determined from HPI is linear, thereby reducing the degree of uncertainty in the prediction.

Based on Graph 5, it would appear that the best matched topographic prediction is "no accretion." Still, the HPI is predicting much worse saltmarsh loss for the future compared with the LTEI. Given the rate of sea level rise used for the LTEI scenarios (6mm per annum), this is surprising. The HPI prediction appears fairly reliable, therefore it can be deduced that local factors must be playing a major role in saltmarsh loss (such as wave attack, dredging, *Spartina* dieback, and possibly pollution), rather than a straight relationship between topography and tide. If these local factors continue in the future then the LTEI prediction maybe optimistic. Results show that saltmarsh at Beaulieu will be non-existent by 2033 based on current rates of loss derived from HPI and will have 18 ha by 2105 based on the relationship between topography and tide (Graph 5).

1.6 Calshot

Results from the LTEI are compared with the HPI prediction in Graph 6; these show projections for saltmarsh area based on existing management.

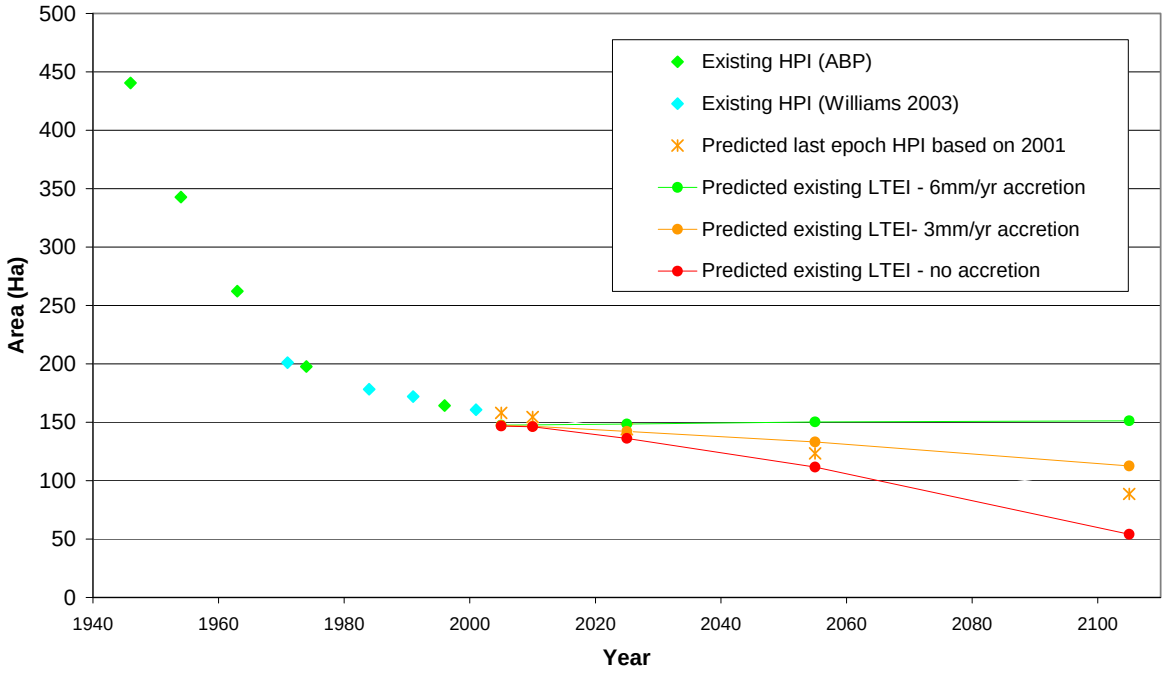


Graph 6: "Existing" and "potential" predicted saltmarsh extent at Calshot (comparison of HPI and LTEI)

The rate of historical saltmarsh loss has slowed since 1971 (Graph 4.6a in the main report). This has resulted in the "last" epoch HPI prediction matching well with the "no accretion" LTEI scenario. If the "last" epoch HPI prediction continues into the future then this indicates that maybe topography and tide, rather than local factors, are influencing saltmarsh loss at Calshot. However, it should be pointed out that there is not a high degree of confidence in the HPI predictions, in that the "worst case" epoch predicts saltmarsh extinction by 2015 and the "last/best" epoch does not predict extinction by 2105 (Graph 4.6a in the main report). The rate of saltmarsh loss has been variable since 1940. Results show that saltmarsh at Calshot will be non-existent by 2105 based on current rates of loss derived from HPI and LTEI (Graph 6).

1.7 Southampton Water

Results from the LTEI are compared with the HPI prediction in Graph 7; these show projections for saltmarsh area based on existing management.

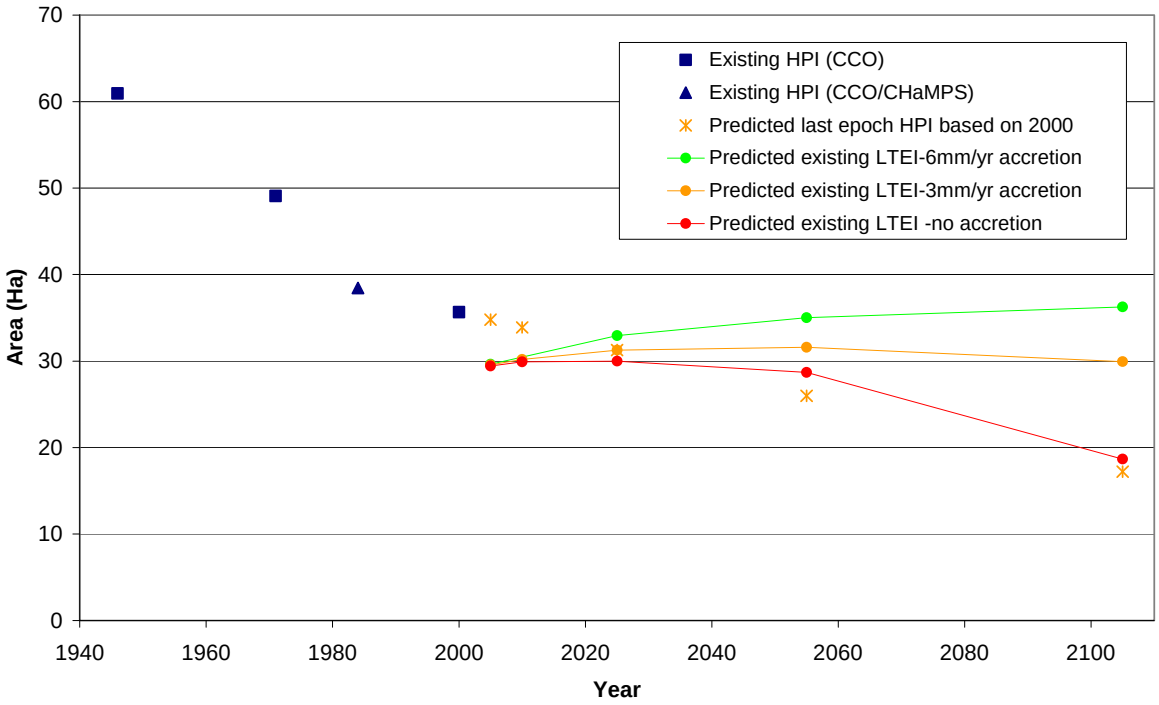


Graph 7: "Existing" and "potential" predicted saltmarsh extent at Southampton Water (comparison of HPI and LTEI)

Graph 7 shows that the historical rate of saltmarsh loss determined from HPI is slowing. This has resulted in the "last" epoch HPI prediction matching well with the "3mm sediment accretion per annum" If the "last" epoch HPI prediction continues into the future then this indicates that maybe topography and tide, rather than local factors are influencing saltmarsh loss in Southampton Water. However, it should be pointed out that there is not a high degree of confidence in the HPI predictions, in that the "worst case" epoch predicts saltmarsh extinction by 2055 (Graph 4.7a in the main report) and the "last/best" epoch and the LTEI predictions do not predict extinction by 2105 (Graph 7).

1.8 Hamble

Results from the LTEI are compared with the HPI prediction in Graph 8; these show projections for saltmarsh area based on existing management.

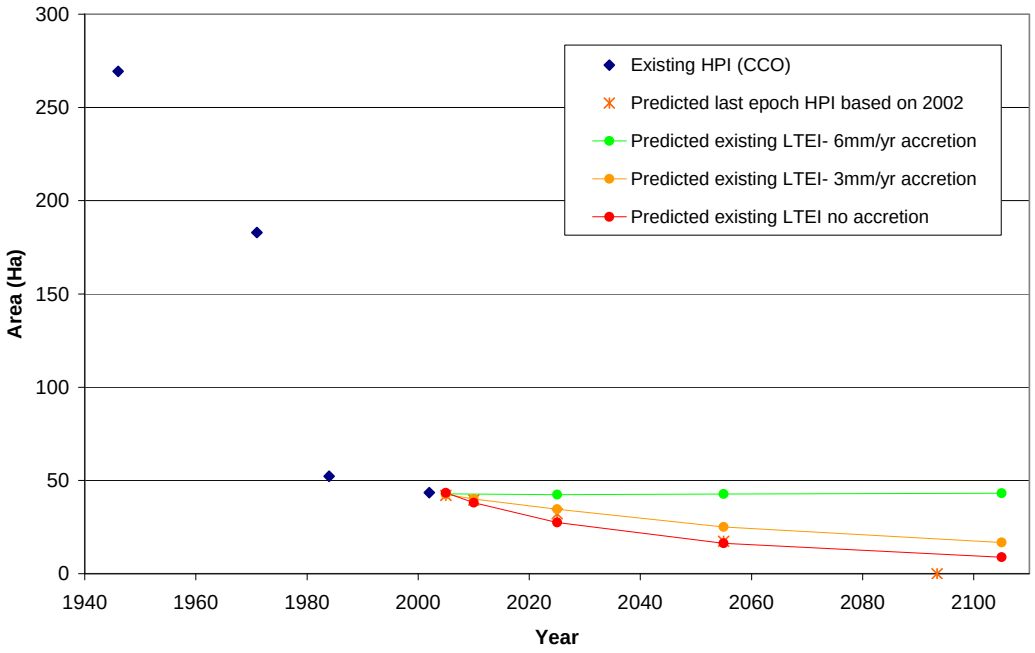


Graph 8: "Existing" and "potential" predicted saltmarsh extent within Hamble (comparison of HPI and LTEI)

The rate of historical saltmarsh loss has slowed since 1971 (Graph 8). This has resulted in the last epoch prediction matching well with the "no accretion" LTEI scenario. If the "last" epoch HPI prediction continues into the future then this indicates that maybe topography and tide, rather than local factors are influencing saltmarsh loss. However, it should be pointed out that there is not a high degree of confidence in the HPI predictions, in that the "worst case" epoch predicts saltmarsh extinction by 2045 (Graph 4.8a in the main report) and the "last/best" epoch and the LTEI predictions do not predict extinction by 2105 (Graph 8).

1.9 Portsmouth Harbour

Results from the LTEI are compared with the HPI prediction in Graph 9; these show projections for saltmarsh area based on existing management.

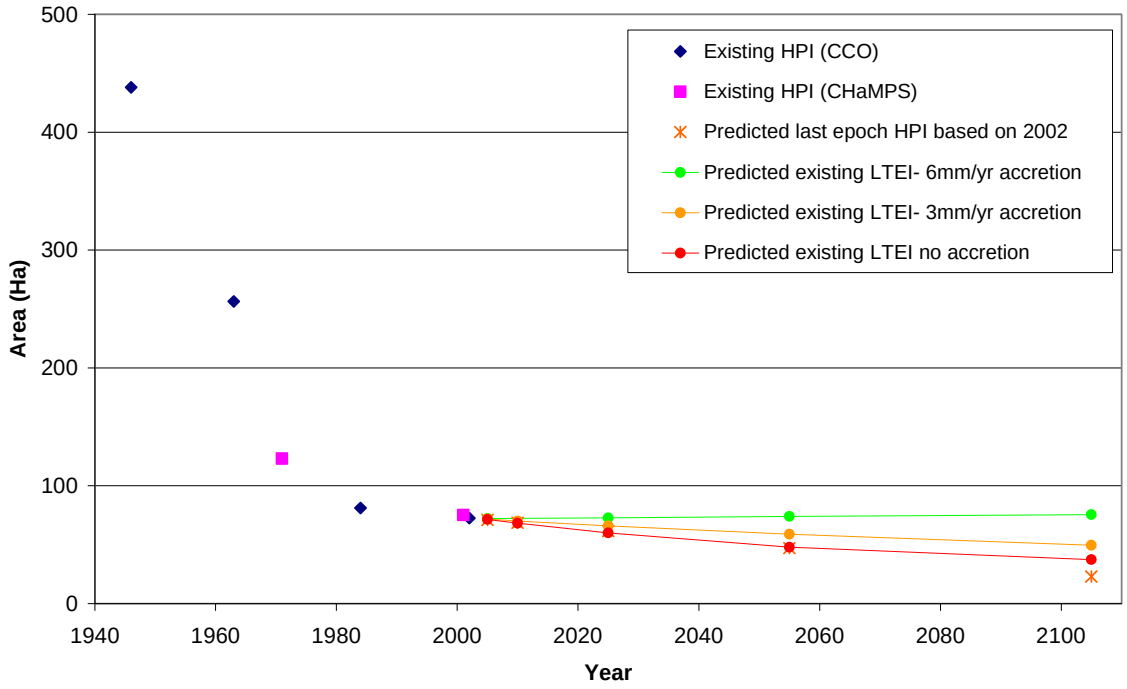


Graph 9: "Existing" and "potential" predicted saltmarsh extent within Portsmouth Harbour (comparison of HPI and LTEI)

The rate of historical saltmarsh loss has slowed since 1984 (Graph 9). This has resulted in the "last" epoch HPI prediction matching well with the "no accretion" LTEI scenario. However, it should be pointed out that there is not a high degree of confidence in the HPI predictions, in that the "worst case" epoch predicts saltmarsh extinction by 2010 and the "last/best" epoch predicts extinction by 2093 (Graph 4.9a in the main report). Results show that saltmarsh at Portsmouth will be non-existent by 2093 based on current rates of loss derived from HPI and will have only 8 ha by 2105 according to LTEI (Graph 9).

1.10 Langstone Harbour

Results from the LTEI are compared with the HPI prediction in Graph 10; these show projections for saltmarsh area based on existing management.

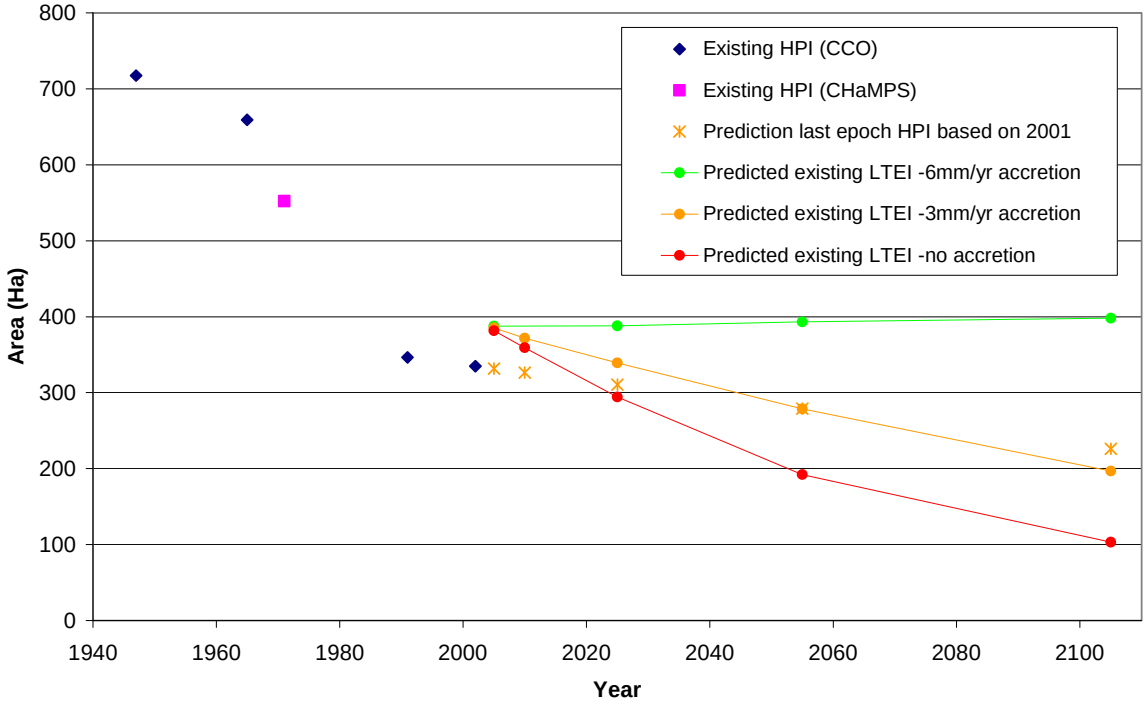


Graph 10: "Existing" saltmarsh prediction in Langstone Harbour (comparison of HPI and LTEI)

Graph 4.10a in the main report shows that the historical rate of saltmarsh loss determined from HPI is slowing. This has resulted in the "last" epoch HPI prediction matching well with the "no accretion" LTEI scenario. If the "last" epoch HPI prediction continues into the future then this indicates that maybe topography and tide, rather than local factors, are influencing saltmarsh loss in Langstone Harbour. However, it should be pointed out that there is not a high degree of confidence in the HPI predictions, in that the "worst case" epoch predicts saltmarsh extinction by 2010 (Graph 4.10a in the main report) and the "last/best" epoch and the LTEI predictions do not predict extinction by 2105 (Graph 10).

1.11 Chichester Harbour

Results from the LTEI are compared with the HPI prediction in Graph 11; these show projections for saltmarsh area based on existing management.

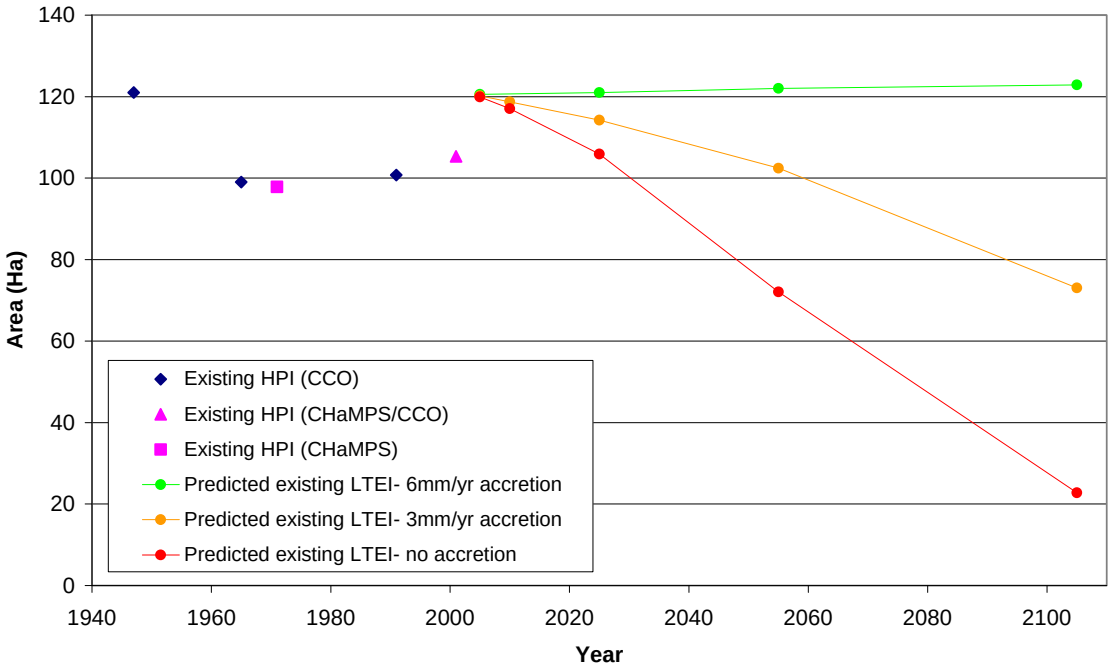


Graph 11: "Existing" saltmarsh prediction in Chichester Harbour (comparison of HPI and LTEI)

Graph 11 shows that the historical rate of saltmarsh loss determined from HPI is slowing. This has resulted in the "last" epoch HPI prediction matching well with the "3mm sediment accretion" LTEI scenario (Graph 11). If the "last" epoch HPI prediction continues into the future then this indicates that local factors are not influencing saltmarsh loss as much as other areas in the north Solent (i.e. the west Solent). However, it should be pointed out that there is not a high degree of confidence in the HPI predictions, in that the "worst case" epoch predicts saltmarsh extinction by 2022 (Graph 4.11a in the main report) and the "last/best" epoch and the LTEI predictions do not predict extinction by 2105 (Graph 11).

1.12 Pagham Harbour

Results from the LTEI are compared with the HPI prediction in Graph 12; these show projections for saltmarsh area based on existing management.



Graph 12: "Existing" saltmarsh prediction in Pagham Harbour (comparison of HPI and LTEI)

Graph 12 shows a decrease in saltmarsh extent from 1947 to 1971, at which point there is an increase in area. Comparison of HPI and LTEI predictions are therefore difficult. According to the "last" epoch HPI prediction, if saltmarsh colonization continues at the same rate, there will be 153 ha of saltmarsh by 2105 (Graph 4.12a in the main report). According to the LTEI "no accretion" and "3mm sediment accretion per annum" scenario, there will be 23 ha by 2105 and 73 ha by 2105 respectively (Graph 12). However, it should be pointed out that there is not a high degree of confidence in the HPI predictions, in that the "worst case" epoch predicts saltmarsh extinction by 2091 and the "last/best" epoch do not predict extinction by 2105 (Graph 4.12a in the main report).

1.2 Validation of LTEI

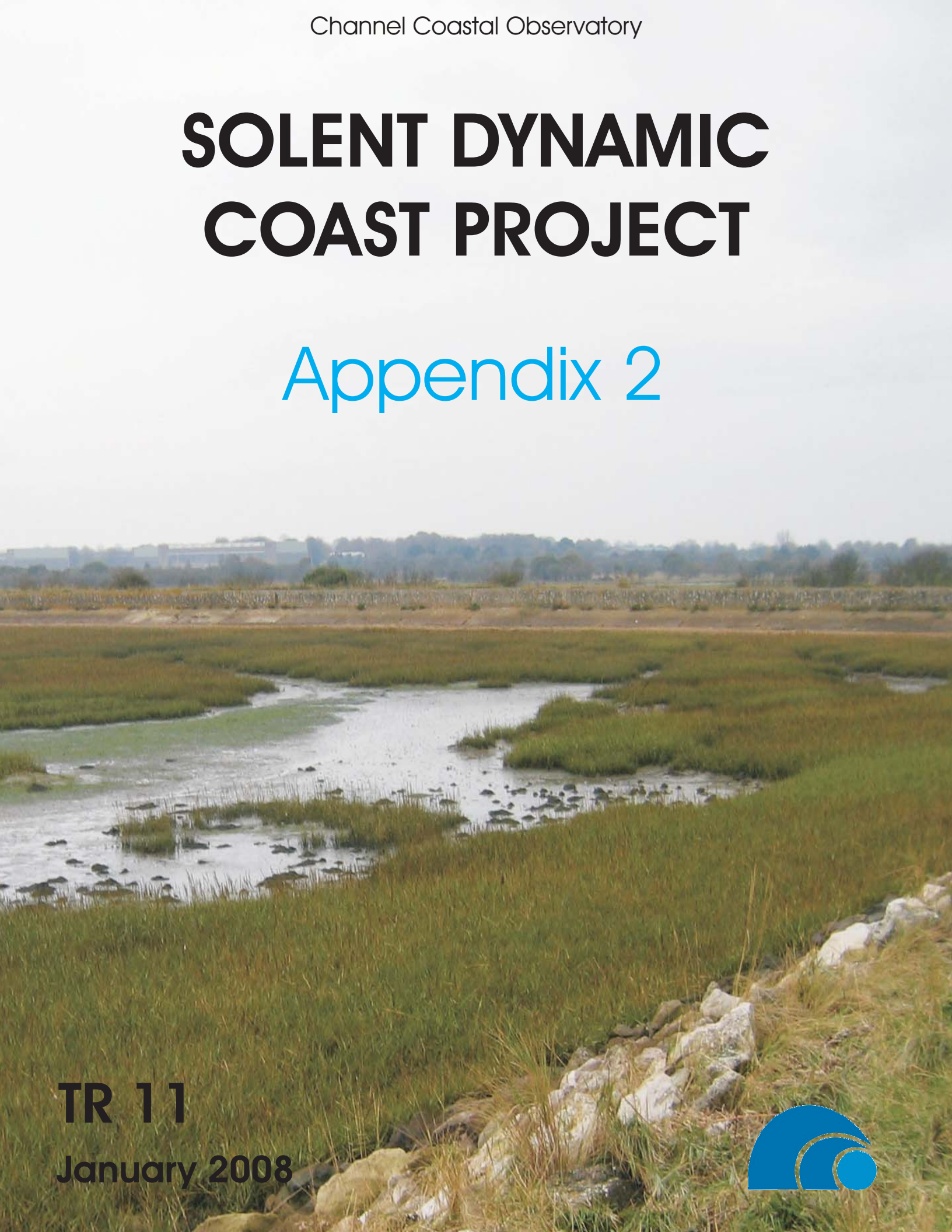
When comparing the three LTEI saltmarsh scenarios (no sediment accretion, 3mm and 6mm per annum) for 2025, 2055 and 2105 with the HPI last bi-decadal prediction, the correlation was better for the harbours (Figure 4.9d and 4.10d) and Southampton Water (4.7c) than with sites in the west Solent (Figure 4.3d). It is suggested that this could be because the LIDAR interpretation accounts only for topography and tide, not local factors, such as wave attack, which is a major driver of saltmarsh loss in the west Solent. Consequently, the predictions for intertidal loss, based on LTEI, were conservative compared with the HPI predictions.

The LTEI mudflat prediction for the existing management regime could not be compared with any HPI findings because the historical photography infrequently reached MLWS and was therefore not digitized.

Channel Coastal Observatory

SOLENT DYNAMIC COAST PROJECT

Appendix 2



TR 11

January 2008

MATRIX A - Placing of Potential Habitat Creation Sites into Epochs

SECTION A – to be completed by SDCP project team

Name of Potential Habitat Creation Site: Saltgrass Lane

Coastal Cell: West Solent

Defence maintained by EA

FINAL RESULT Final choice of epoch category -

	Number of Hectares Creation	Number of Hectares that can be used for compensation/ mitigation	Number of Hectares of any replacement freshwater habitat	No of Hectares of replacement habitat that can be found on site	Tick box in which epoch the replacement freshwater habitat should be started
EPOCH A - 0 - 19 Years	16	16	5	5	NOW
EPOCH B - 20 - 49 Years					
EPOCH C - 50 - 99 years					
EPOCH D 100 + years					
ABANDON as no benefit-cost					
HOLD THE LINE					

Rationale for choice of final epoch

Approximately half the site is designated and will need to be replaced when realignment take place. There maybe room for this replacement habitat on the site itself and this may mean that the marginal benefit-cost to realign won't be compromised. RTE could be 0-19.

Environmental Benefit of Realigning over 100 years – this section to be filled in before asking Q1.

	Hectares Saltmarsh	Hectares Mudflat	Natural transitions Cross box	Self sustaining Cross box	Opps for freshwater habitat
EPOCH A - 0 - 19 Years	7	4	Partial	partial	x
EPOCH B - 20 - 49 Years					
EPOCH C - 50 - 99 years					
EPOCH D 100 + years	7	9			

As a result of the above, is the environmental benefit of realigning High, Medium or Low?

High	
Medium	
Low	x

Cross box

QUESTIONNAIRE FOR COASTAL MANAGERS

MAIN ROUTING QUESTION

Q1. **Would any realignment be over all or part of designated site? Depending on the answer please go to the appropriate section.**

	Cross Box	
Non-designated		**go to SECTION B**
Designated	**x**	**go to SECTION C**

SECTION C DESIGNATED SITE behind sea wall

Flood Risk

Q9. **Using Flood Zone 3 (1:200 probability flood), would realignment cause any flood risk to built assets**

	Cross box
Yes	**x**
No	

IF NO GO TO Q15 and consider placing in low EPOCH

Q10. **Please put as much detail as possible relating to flood risk and potential realignment to help you decide in what EPOCH to realign the site.**

Number of properties	**Approx 50**
Recreational site – Country park, footpaths, informal recreation	**Footpath**
Type of infrastructure – housing, industrial, road, landfill	**Road, housing, commercial, industrial**
Length of current defence	**1133m**
Length of any potential realigned defence	**973m**
Realignment cause further risk to property/infrastructure	**no**

Q11a. **In what EPOCH below will the standard of service need to be improved – in other words, given sea level rise, when will the defence need to be raised to provide an adequate standard?**

Q11b. **In what EPOCH below will the defence fail, given your estimates of standard of protection (condition) and residual life**

	Cross box	
	a) Service	b) Residual life
0 - 19	**x**	**x**
20 - 49		
50 - 99		
100 +		

Q12. **Do you predict that at the time it would need capital expenditure it will meet benefit-cost (according to EA flood Zone Flood Zone 3 (1:200 probability flood)?**

	Cross box
Yes	**x**
No	

Q13. So, would the re-aligned route meet benefit-cost?

Yes	**x**
No	

IF "NO" for both Q12 and Q13, go to Q15 to record when to abandon (Exit Strategy required)

Q14. (This only applies if the current or re-aligned route (or both), meet benefit-cost) **Would the benefit-cost be better, the same or worse on a realigned route?**

	Cross box	
Better benefit-cost to realign		If YES, chose epoch in Q8 based on Q4.
Same	**x**	If YES, chose epoch in Q8 based on Q4.
Worse benefit-cost to realign		Go to Q15 and chose "HOLD THE LINE"

Q15. Given the above, when can the site be realigned to protect infrastructure, assuming funds available, and if so in what EPOCH*

	Re-align	RTE	Abandon	HTL	EPOCH
0 - 19					Epoch A
20 - 49					Epoch B
50 - 99					Epoch C
100 +					Epoch D
HOLD THE LINE	x	x			

***GUIDE TO ANSWERING THE ABOVE QUESTION:**

- recommend realigning when current life of defences no longer acceptable.
- If however the benefit-cost would be worse to realign and particularly if site is small (ie: relative cost would be particularly high, consider placing in Category D or as "HOLD THE LINE"

Designations behind sea wall (Remaining questions to be filled in by NE)

Q16. What is the name of the designated site?

European Site	**Solent and Southampton water Ramsar** **Solent and Southampton water SPA**
National Site	**Hurst to Lymington Estuary SSSI**

Q17. Nature conservation, European site (ES) and SSSI issues

	0-19	20-49	50-99	100+
(ES) Is it economically viable to maintain the defences in situ and at what standard of defence?				
(ES/SSSI) Over time will the designated ' freshwater habitat' behind sea wall continue to meet its conservation objectives given above standard of defence/ predicted saline intrusion. Consider RTE	**yes**	**yes**	**yes**	**yes**
(ES/SSSI) If habitat were to change in response to a reduction in flood defence, would it be acceptable for the conservation objectives. Consider RTE	**yes**	**yes**	**yes**	**yes**
(ES) If replacement freshwater habitat required, at what time should this be available as fully functional habitat?	**Possibly 5 if RTE**			
(ES) When would it be necessary to begin to create replacement 'freshwater habitat' (ie how long would it take to create) ?	**Now**			
Is it necessary to extend the time of the defence to allow replacement habitat to be created?	**Wet grassland, reedbed?**			

Q18. On the basis of the nature conservation issues when could the site be realigned

	Re-align	RTE	Abandon	HTL	EPOCH
0 - 19	x				Epoch A
20 - 49					Epoch B
50 - 99					Epoch C
100 +					Epoch D
HOLD THE LINE					

***GUIDE TO ANSWERING THE ABOVE QUESTION:**

- recommend realigning when current life of defences no longer acceptable
- If habitat is rare, may need to allow enough time to acquire and develop replacement habitat.

MATRIX A - Placing of Potential Habitat Creation Sites into Epochs

SECTION A – to be completed by SDCP project team

Name of Potential Habitat Creation Site: Avon Water

Coastal Cell: West Solent

Defence maintained by CA (EA sluice)

FINAL RESULT Final choice of epoch category -

	Number of Hectares Creation	Number of Hectares that can be used for compensation/ mitigation	Number of Hectares of any replacement freshwater habitat	No of Hectares of replacement habitat that can be found on site	Tick box in which epoch the replacement freshwater habitat should be started
EPOCH A - 0 - 19 Years					
EPOCH B - 20 - 49 Years					
EPOCH C - 50 - 99 years					
EPOCH D 100 + years					
ABANDON as no benefit-cost					
HOLD THE LINE	41	N/A	N/A	N/A	N/A

Rationale for choice of final epoch

Landfill on the edge. Not economically viable to re-align. RTE is an option. The designated features will be maintained by defence, and could accept some habitat change if more saline conditions were introduced.

Environmental Benefit of Realigning over 100 years – this section to be filled in before asking Q1.

	Hectares Saltmarsh	Hectares Mudflat	Natural transitions Cross box	Self sustaining Cross box	Opps for freshwater habitat
EPOCH A - 0 - 19 Years	7	29			
EPOCH B - 20 - 49 Years					
EPOCH C - 50 - 99 years					
EPOCH D 100 + years	7	34	N	N	N

As a result of the above, is the environmental benefit of realigning High, Medium or Low?

High	
Medium	x
Low	

Cross box

QUESTIONNAIRE FOR COASTAL MANAGERS

MAIN ROUTING QUESTION

Q1. Would any realignment be over all or part of designated site? Depending on the answer please go to the appropriate section.

	Cross Box	
Non-designated		**go to SECTION B**
Designated	**x**	**go to SECTION C**

SECTION C DESIGNATED SITE behind sea wall

Flood Risk

Q9. Using Flood Zone 3 (1:200 probability flood), would realignment cause any flood risk to built assets

	Cross box
Yes	**x**
No	

IF NO GO TO Q15 and consider placing in low EPOCH

Q10. Please put as much detail as possible relating to flood risk and potential realignment to help you decide in what EPOCH to realign the site.

Number of properties	**Approx 70**
Recreational site – Country park, footpaths, informal recreation	**Footpaths, car parking**
Type of infrastructure – housing, industrial, road, landfill	**Housing, landfill, agriculture, road**
Length of current defence	**2000 m**
Length of any potential realigned defence	**5000 m**
Realignment cause further risk to property/infrastructure	

Q11a. In what EPOCH below will the standard of service need to be improved – in other words, given sea level rise, when will the defence need to be raised to provide an adequate standard?

Q11b. In what EPOCH below will the defence fail, given your estimates of standard of protection (condition) and residual life

	Cross box	
	a) Service	b) Residual life
0 - 19		
20 - 49		
50 - 99		**x**
100 +		

Q12. Do you predict that at the time it would need capital expenditure it will meet benefit-cost (according to EA flood Zone Flood Zone 3 (1:200 probability flood)?

	Cross box
Yes	**x**
No	

Q13. So, would the re-aligned route meet benefit-cost?

Yes	**x**
No	

IF "NO" for both Q12 and Q13, go to Q15 to record when to abandon (Exit Strategy required)

Q14. (This only applies if the current or re-aligned route (or both), meet benefit-cost) Would the benefit-cost be better, the same or worse on a realigned route?

	Cross box	
Better benefit-cost to realign		If YES, chose epoch in Q8 based on Q4.
Same		If YES, chose epoch in Q8 based on Q4.
Worse benefit-cost to realign	**x**	Go to Q15 and chose "HOLD THE LINE"

Q15. Given the above, when can the site be realigned to protect infrastructure, assuming funds available, and if so in what EPOCH*

	Re-align	RTE	Abandon	HTL	EPOCH
0 - 19					Epoch A
20 - 49					Epoch B
50 - 99					Epoch C
100 +					Epoch D
HOLD THE LINE				x	

***GUIDE TO ANSWERING THE ABOVE QUESTION:**

- recommend realigning when current life of defences no longer acceptable.
- If however the benefit-cost would be worse to realign and particularly if site is small (ie: relative cost would be particularly high, consider placing in Category D or as "HOLD THE LINE"

Designations behind sea wall (Remaining questions to be filled in by NE)

Q16. What is the name of the designated site?

European Site	**Solent and Southampton Water SPA** **Solent and Southampton Water RAMSAR**
National Site	**Hurst Castle and Lymington River SSSI**

Q17. Nature conservation, European site (ES) and SSSI issues

	0-19	20-49	50-99	100+
(ES) Is it economically viable to maintain the defences in situ and at what standard of defence?	**Yes**	**Yes**	**Yes**	
(ES/SSSI) Over time will the designated ' freshwater habitat' behind sea wall continue to meet its conservation objectives given above standard of defence/ predicted saline intrusion. Consider RTE	**If RTE then yes**	**yes**	**Yes**	
(ES/SSSI) If habitat were to change in response to a reduction in flood defence, would it be acceptable for the conservation objectives. Consider RTE	**If RTE then yes**	**yes**	**Yes**	
(ES) If replacement freshwater habitat required, at what time should this be available as fully functional habitat?	**N/A**			
(ES) When would it be necessary to begin to create replacement 'freshwater habitat' (ie how long would it take to create) ?				
Is it necessary to extend the time of the defence to allow replacement habitat to be created?				

Q18. On the basis of the nature conservation issues when could the site be realigned

	Re-align	RTE	Abandon	HTL	EPOCH
0 - 19					Epoch A
20 - 49					Epoch B
50 - 99					Epoch C
100 +					Epoch D
HOLD THE LINE		x		x	

***GUIDE TO ANSWERING THE ABOVE QUESTION:**

- recommend realigning when current life of defences no longer acceptable
- If habitat is rare, may need to allow enough time to acquire and develop replacement habitat.

MATRIX A - Placing of Potential Habitat Creation Sites into Epochs

SECTION A – to be completed by SDCP project team

Name of Potential Habitat Creation Site: Keyhaven a

Coastal Cell: West Solent

Defence maintained by EA

FINAL RESULT Final choice of epoch category -

	Number of Hectares Creation	Number of Hectares that can be used for compensation/ mitigation	Number of Hectares of any replacement freshwater habitat	No of Hectares of replacement habitat that can be found on site	Tick box in which epoch the replacement freshwater habitat should be started
EPOCH A - 0 - 19 Years					
EPOCH B - 20 - 49 Years					
EPOCH C - 50 - 99 years					
EPOCH D 100 + years					
ABANDON as no benefit-cost					
HOLD THE LINE	24	N/A	N/A	N/A	N/A

Rationale for choice of final epoch

When the wall is at the end of its residual life the benefit-cost will be the same or better to realign. However if factor in the cost of replacement habitat (which will be required by NE), the benefit-cost may be worse. For this reason it has been categorised as, "Hold the Line". This may be changed however if there is insufficient habitat in the Solent to balance losses and funding could be found. Realignment would need to protect the landfill.

Environmental Benefit of Realigning over 100 years – this section to be filled in before asking Q1.

	Hectares Saltmarsh	Hectares Mudflat	Natural transitions Cross box	Self sustaining Cross box	Opps for freshwater habitat
EPOCH A - 0 - 19 Years	3	21	n	n	n
EPOCH B - 20 - 49 Years					
EPOCH C - 50 - 99 years					
EPOCH D 100 + years	2	22	n	n	n

As a result of the above, is the environmental benefit of realigning High, Medium or Low?

High	
Medium	
Low	x

Cross box

QUESTIONNAIRE FOR COASTAL MANAGERS

MAIN ROUTING QUESTION

Q1. **Would any realignment be over all or part of designated site? Depending on the answer please go to the appropriate section.**

	Cross Box	
Non-designated		**go to SECTION B**
Designated	**x**	**go to SECTION C**

SECTION C DESIGNATED SITE behind sea wall

Flood Risk

Q9. **Using Flood Zone 3 (1:200 probability flood), would realignment cause any flood risk to built assets**

	Cross box
Yes	**x**
No	

IF NO GO TO Q15 and consider placing in low EPOCH

Q10. **Please put as much detail as possible relating to flood risk and potential realignment to help you decide in what EPOCH to realign the site.**

Number of properties	**5 or 6**
Recreational site – Country park, footpaths, informal recreation	**Footpath**
Type of infrastructure – housing, industrial, road, landfill	**Housing and road**
Length of current defence	**1400m**
Length of any potential realigned defence	**1102m**
Realignment cause further risk to property/infrastructure	**None**

Q11a. **In what EPOCH below will the standard of service need to be improved – in other words, given sea level rise, when will the defence need to be raised to provide an adequate standard?**

Q11b. **In what EPOCH below will the defence fail, given your estimates of standard of protection (condition) and residual life**

	Cross box	
	a) Service	b) Residual life
0 - 19		**x**
20 - 49		
50 - 99	**x**	
100 +		

Q12. **Do you predict that at the time it would need capital expenditure it will meet benefit-cost (according to EA flood Zone Flood Zone 3 (1:200 probability flood)?**

	Cross box
Yes	**x**
No	

Q13. So, would the re-aligned route meet benefit-cost?

Yes	**x**
No	

IF "NO" for both Q12 and Q13, go to Q15 to record when to abandon (Exit Strategy required)

Q14. **(This only applies if the current or re-aligned route (or both), meet benefit-cost) Would the benefit-cost be better, the same or worse on a realigned route?**

	Cross box	
Better benefit-cost to realign		If YES, chose epoch in Q8 based on Q4.
Same	**x**	If YES, chose epoch in Q8 based on Q4.
Worse benefit-cost to realign		Go to Q15 and chose "HOLD THE LINE"

Q15. Given the above, when can the site be realigned to protect infrastructure, assuming funds available, and if so in what EPOCH*

	Re-align	RTE	Abandon	HTL	EPOCH
0 - 19					Epoch A
20 - 49					Epoch B
50 - 99					Epoch C
100 +					Epoch D
HOLD THE LINE				x	

***GUIDE TO ANSWERING THE ABOVE QUESTION:**

- recommend realigning when current life of defences no longer acceptable.
- If however the benefit-cost would be worse to realign and particularly if site is small (ie: relative cost would be particularly high, consider placing in Category D or as "HOLD THE LINE"

Designations behind sea wall (Remaining questions to be filled in by NE)

Q16. What is the name of the designated site?

European Site	**Solent and Southampton Water SPA** **Solent and Southampton Water RAMSAR**
National Site	**Hurst Castle and Lymington River SSSI**

Q17. Nature conservation, European site (ES) and SSSI issues

	0-19	20-49	50-99	100+
(ES) Is it economically viable to maintain the defences in situ and at what standard of defence?	**YES**	**NO**	**NO**	
(ES/SSSI) Over time will the designated ' freshwater habitat' behind sea wall continue to meet its conservation objectives given above standard of defence/ predicted saline intrusion. Consider RTE	**YES**	**NO**	**NO**	**NO**
(ES/SSSI) If habitat were to change in response to a reduction in flood defence, would it be acceptable for the conservation objectives. Consider RTE				
(ES) If replacement freshwater habitat required, at what time should this be available as fully functional habitat?		**YES for SPA +**		
(ES) When would it be necessary to begin to create replacement 'freshwater habitat' (ie how long would it take to create) ?	**50 years**			
Is it necessary to extend the time of the defence to allow replacement habitat to be created?				

Q18. On the basis of the nature conservation issues when could the site be realigned

	Re-align	RTE	Abandon	HTL	EPOCH
0 - 19					Epoch A
20 - 49					Epoch B
50 - 99					Epoch C
100 +					Epoch D
HOLD THE LINE	**HTL otherwise re-align 50-99**			x	

***GUIDE TO ANSWERING THE ABOVE QUESTION:**

- recommend realigning when current life of defences no longer acceptable
- If habitat is rare, may need to allow enough time to acquire and develop replacement habitat.

MATRIX A - Placing of Potential Habitat Creation Sites into Epochs

SECTION A – to be completed by SDCP project team

Name of Potential Habitat Creation Site: Keyhaven b

Coastal Cell: West Solent

Defence maintained by EA

FINAL RESULT Final choice of epoch category -

	Number of Hectares Creation	Number of Hectares that can be used for compensation/ mitigation	Number of Hectares of any replacement freshwater habitat	No of Hectares of replacement habitat that can be found on site	Tick box in which epoch the replacement freshwater habitat should be started
EPOCH A - 0 - 19 Years					
EPOCH B - 20 - 49 Years					
EPOCH C - 50 - 99 years					
EPOCH D 100 + years					
ABANDON as no benefit-cost					
HOLD THE LINE	101	N/A	N/A	N/A	N/A

Rationale for choice of final epoch

When the wall is at the end of its residual life the benefit-cost will be the same or better to realign. However if factor in the cost of replacement habitat (which will be required by NE), the benefit-cost may be worse. For this reason it has been categorised as, "Hold the Line". This may be changed however if there is insufficient habitat in the Solent to balance losses and funding could be found.

Environmental Benefit of Realigning over 100 years – this section to be filled in before asking Q1.

	Hectares Saltmarsh	Hectares Mudflat	Natural transitions Cross box	Self sustaining Cross box	Opps for freshwater habitat
EPOCH A - 0 - 19 Years	18	77	n	n	n
EPOCH B - 20 - 49 Years					
EPOCH C - 50 - 99 years					
EPOCH D 100 + years	8	93			

As a result of the above, is the environmental benefit of realigning High, Medium or Low?

High	x
Medium	
Low	

Cross box

QUESTIONNAIRE FOR COASTAL MANAGERS

MAIN ROUTING QUESTION

Q1. **Would any realignment be over all or part of designated site? Depending on the answer please go to the appropriate section.**

	Cross Box	
Non-designated		**go to SECTION B**
Designated	**x**	**go to SECTION C**

SECTION C DESIGNATED SITE behind sea wall

Flood Risk

Q9. **Using Flood Zone 3 (1:200 probability flood), would realignment cause any flood risk to built assets**

	Cross box
Yes	**x**
No	

IF NO GO TO Q15 and consider placing in low EPOCH

Q10. **Please put as much detail as possible relating to flood risk and potential realignment to help you decide in what EPOCH to realign the site.**

Number of properties	**30-50**
Recreational site – Country park, footpaths, informal recreation	**Footpath**
Type of infrastructure – housing, industrial, road, landfill	**Housing, road, landfill**
Length of current defence	**4000**
Length of any potential realigned defence	**2500**
Realignment cause further risk to property/infrastructure	**?**

Q11a. **In what EPOCH below will the standard of service need to be improved – in other words, given sea level rise, when will the defence need to be raised to provide an adequate standard?**

Q11b. **In what EPOCH below will the defence fail, given your estimates of standard of protection (condition) and residual life**

	Cross box	
	a) Service	b) Residual life
0 - 19		**x**
20 - 49		
50 - 99	**x**	
100 +		

Q12. **Do you predict that at the time it would need capital expenditure it will meet benefit-cost (according to EA flood Zone Flood Zone 3 (1:200 probability flood)?**

	Cross box
Yes	**x**
No	

Q13. So, would the re-aligned route meet benefit-cost?

Yes	**x if it were possible to**
No	

IF "NO" for both Q12 and Q13, go to Q15 to record when to abandon (Exit Strategy required)

Q14. (This only applies if the current or re-aligned route (or both), meet benefit-cost) **Would the benefit-cost be better, the same or worse on a realigned route?**

	Cross box	
Better benefit-cost to realign	**x if it were possible to**	If YES, chose epoch in Q8 based on Q4.
Same		If YES, chose epoch in Q8 based on Q4.
Worse benefit-cost to realign		Go to Q15 and chose "HOLD THE LINE"

Q15. Given the above, when can the site be realigned to protect infrastructure, assuming funds available, and if so in what EPOCH*

	Re-align	RTE	Abandon	HTL	EPOCH
0 - 19					Epoch A
20 - 49					Epoch B
50 - 99					Epoch C
100 +					Epoch D
HOLD THE LINE				x	

***GUIDE TO ANSWERING THE ABOVE QUESTION:**

- recommend realigning when current life of defences no longer acceptable.
- If however the benefit-cost would be worse to realign and particularly if site is small (ie: relative cost would be particularly high, consider placing in Category D or as "HOLD THE LINE"

Designations behind sea wall (Remaining questions to be filled in by NE)

Q16. What is the name of the designated site?

European Site	**Solent and Southampton Water SPA**
National Site	**Hurst to Lymington SSS**

Q17. Nature conservation, European site (ES) and SSSI issues

	0-19	20-49	50-99	100+
(ES) Is it economically viable to maintain the defences in situ and at what standard of defence?	yes	yes	yes	yes
(ES/SSSI) Over time will the designated ' freshwater habitat' behind sea wall continue to meet its conservation objectives given above standard of defence/ predicted saline intrusion. Consider RTE	yes	yes	yes	yes
(ES/SSSI) If habitat were to change in response to a reduction in flood defence, would it be acceptable for the conservation objectives. Consider RTE	N?	N?	N?	N?
(ES) If replacement freshwater habitat required, at what time should this be available as fully functional habitat?			x?	
(ES) When would it be necessary to begin to create replacement 'freshwater habitat' (ie how long would it take to create) ?	X?			
Is it necessary to extend the time of the defence to allow replacement habitat to be created?				

Q18. On the basis of the nature conservation issues when could the site be realigned

	Re-align	RTE	Abandon	HTL	EPOCH
0 - 19					Epoch A
20 - 49					Epoch B
50 - 99					Epoch C
100 +					Epoch D
HOLD THE LINE	HTL otherwise re-align 50-99			x	

***GUIDE TO ANSWERING THE ABOVE QUESTION:**

- recommend realigning when current life of defences no longer acceptable
- If habitat is rare, may need to allow enough time to acquire and develop replacement habitat.