

C3 Climate Change and Sea Level Rise

C3.1 Introduction

The global climate is constantly changing, but it is generally recognised that we are entering a period of change, particularly with respect to rising sea levels and the anticipated implications of climate change and sea level rise present a significant challenge to future coastal management. Over the last few decades, there have been numerous studies into the impact of potential changes in the future, however, there remains considerable uncertainty both within the science of future climate modelling and associated with future global development patterns.

C3.2 Sea Level Rise

The north-east coast is believed to be still responding to changes during the last 10,000 years when sea levels rose rapidly, flooding the North Sea Basin, but there is now concern over human-induced acceleration in sea level rise due to climate change. Relative sea level change depends upon changes in global sea level (eustatic change) and in land-level (isostatic change).

Isostatic change is the change in land level as the crust slowly readjusts to unloading of the weight of the ice since the last Ice Age. Therefore, areas which were covered by ice, i.e. northern England and Scotland, have been experiencing a rise in land levels over the last few thousand years, whereas the southern areas of England has been subsiding. The fulcrum of the re-adjustment is approximately at Tees Bay.

Eustatic change can be influenced by climatic changes. Evidence suggests that global average sea level rose by about 1.5mm/year during the twentieth century; this is believed to be due to a number of factors including thermal expansion of warming ocean waters and the melting of land glaciers, but after adjustment for natural land movements, it has been calculated that the average rate of sea level rise during the last century around the UK coastline was approximately 1mm/year.

Predictions of sea level change have been developed by the UK Climate Impacts Programme (UKCIP) for four possible future climate scenarios: Low, Medium-Low, Medium-High and High; these span a range of emissions scenarios and different climate sensitivities. The table below presents the current UKCIP (2002) estimates of future sea level change for the north east of England for the two extreme scenarios, low emissions scenario and high emissions scenario.

	Regional Isostatic Subsidence (mm/yr)	UKCIP Net Sea level Change 2080s (relative to 1961-90) (mm)	
		Low Emissions	High Emissions
NE England	+0.3	60	660

New guidance will be available from UKCIP in spring 2009. In the meantime, for the purposes of developing this SMP2, we have used the guidance allowances recommended by Defra (2006) as follows:

- 2.5mm per year sea level rise up to 2025;
- 7.0mm per year from 2025 to 2055;
- 10.0mm per year from 2055 to 2085; and

- 13mm per year from 2085 to 2115.

C3.3 Storminess

It has been postulated that climate change may increase storminess around the UK, but although the UKCIP02 studies indicate some increase in storminess, there is a high degree of uncertainty and little agreement between models, regarding changes in mid-latitude variability. Therefore, although this is recognised as an uncertainty within the predictions, no detailed analysis of potential impacts has been undertaken.

C3.4 Precipitation

In addition to sea level rise and storminess, the other climate change factor that is important to coastal evolution is precipitation. UKCIP predictions suggest that winters will become wetter but summers may become drier throughout the UK. However, there is potential for heavy winter rain to become more frequent. This may have an impact on the softer cliffs along this coastline which in many places mantle the harder rock geology base and could increase the spate-effects of the rivers, especially the River Tweed which already has a high freshwater flow component.

C4 Baseline Scenarios

The following tables present the implications of No Active Intervention (NAI) and With Present Management (WPM) scenarios on coastal defences and shoreline evolution over the three future time epochs.

The maps which follow the tables show the projected shoreline position under the NAI scenario over the same three time epochs.

The position of the shoreline under the WPM scenario is very similar to the maps contained within the main SMP for each Management Area and therefore have not been reproduced here.

Unit 1	Chainage	0km	15.5km
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Scottish Border to Saltpan How

Baseline management scenarios

No active intervention (NAI)	Scenario description
	This scenario assumes that defences are no longer maintained and will therefore fail over time. Timing of exact defence failure cannot be deduced accurately. However a failure epoch can be determined.

Shoreline response

For the majority of the unit this would not be a change in the present management, however this would result in substantial change around Berwick. Between the Scottish Border and Brotherston's Hole predicted erosion rates are low and over the next 100 years it is unlikely that there will be significant impacts upon the use of the cliff crest. At Marshall Meadow's Bay the caravan park is close to the cliff crest, there is a risk of loss however this is the result of cliff instability rather than erosion at the toe. At Brotherston's Hole there is a risk of cliff failure due to under cutting and caving, from this point southwards predicted erosion rates increase. The higher estimated rates may cut the cliff back 70m removing part of the golf course, the coastal path and Berwick Holiday Park; however typical rates may be around 40m over the next 100 years. The erosion rates would be limited in the first epoch, increasing in the long term due to sea level rise.

At Berwick the North Breakwater is assessed as failing in year 75 although it would start to break up much earlier. Over the SMP period erosion would result in loss of the dunes north of the breakwater followed by the loss of Pier House and Pier Road. Along the northern side of the estuary failure of the walls and defences would cause substantial loss of properties and heritage value. Loss of the breakwater would also expose the sand and mudflats at Calot Shad to increased wave energy; In addition the Tweed is likely to realign its course to the north-east making use of the harbour untenable, with the river developing as distinct flood and ebb channels. Increased exposure would make navigation of the estuary mouth more difficult and increase erosion of the southern bank. Sandstell Spit and Sandstell Point would be eroded, retreating up to 100m over the SMP period; this would lead to loss of the beach in front of Spittal causing failure of the defences there.

The cliffs to the south of Bear's Head would still erode at a slow rate while the crest could retreat more rapidly in areas of local instability, potentially affecting the railway in the long term.

Epoch 1: Years 0 – 20 (2025)		Epoch 2: Years 20 – 50 (2055)		Epoch 3: Years 50 – 100 (2105)	
Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
Failure of gabion defence at Davie's Batt within Tweed Estuary.	Limited erosion of the cliffs.	Failure of remaining defences within the Tweed Estuary	Limited erosion of the cliffs except between Brotherston's Hole and Fisherman's Haven where rates increase.	Berwick North Breakwater fails completely leading to failure of Spittal defences.	Limited erosion of the cliffs north of Ch. 3.5km and south of Bear's Head. Between Ch. 3.5km and Berwick North Breakwater increased erosion rates except at Sharpers Head.

With Present
Management
(WPM)

Scenario description

This scenario assumes that the current policy for the frontage is continued. This will usually involve maintaining defences to provide a similar level of protection to that provided at present and regularly inspecting and maintaining the defences.

Shoreline response

Maintaining the defences at Fisherman's Haven would sustain access to the beach and stabilise sections of the upper slope. The main protection to the Tweed estuary is the North Breakwater; all defences within the estuary and at Spittal rely on this structure, and it maintains the shape of the estuary. Sandstell Spit and the northern end of the Spittal frontage are vulnerable to changes in beach volume and this could increase with loss of sediment to the frontage with sea level rise. The limited width of beach at the southern end of the Spittal frontage will come under increasing pressure from erosion and higher wave energy may reduce beach levels progressively to the north. South of Bear's Head the behaviour will be the same as No Active Intervention.

Epoch 1: Years 0 – 20 (2025)		Epoch 2: Years 20 – 50 (2055)		Epoch 3: Years 50 – 100 (2105)	
Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
Defences would remain.	Similar behaviour to that of the NAI scenario. Limited erosion of the cliffs.	Defences would remain.	Similar behaviour to that of the NAI scenario. Limited erosion of the cliffs.	Defences would remain. Defence maintenance and cost of building new defences would be significant.	Similar behaviour to that of the NAI scenario. Increased rate of erosion of cliffs around Brotherston's Hole.

Unit 2

Chainage

15.5km

46km

Saltpan How to Harkenss Rocks (Including Holy Island)

Baseline management scenarios

No active

intervention

(NAI)

Scenario description

This scenario assumes that defences are no longer maintained and will therefore fail over time. Timing of exact defence failure cannot be deduced accurately. However a failure epoch can be determined.

Shoreline response

The area north of and behind Holy Island is likely to behave in a similar manner to the unconstrained scenario, however some of the interactions may be delayed as the defences fail such as in Budle Bay. In the long term the overall development of the shoreline would be similar. Although there is uncertainty the dunes and shoreline are likely to be driven backwards closing the northern entrance to Holy Island Sands and Fenham Flats resulting in significant change in habitats.

On Holy Island loss of the breakwater at Steel End would increase erosion in the bay to the east of the village, potentially opening up the floodplain behind and exposing properties to greater flood risk. Sea level rise may lead to the loss of the building and boat house to the east of the priory.

Epoch 1: Years 0 – 20 (2025)
Epoch 2: Years 20 – 50 (2055)
Epoch 3: Years 50 – 100 (2105)
Defences

Some defences at Warren Mill fail causing loss of properties.

Natural coast

Limited erosion and roll back of shoreline.

Defences

Defences around Ross Low fail and sluices controlling outfalls are lost.

Natural coast

Limited erosion and roll back of shoreline.

Defences

Further erosion at Ross Low and Warren Mill, more properties lost at Warren Mill.

Natural coast

Limited erosion of shoreline, rate increases with sea level rise. Part of Goswick Fishery lost

With Present

Management

(WPM)

Scenario description

This scenario assumes that the current policy for the frontage is continued. This will usually involve maintaining defences to provide a similar level of protection to that provided at present and regularly inspecting and maintaining the defences.

Shoreline response

From Saltpan How to Holy Island the behaviour of the coastline will be similar to that for No Active Intervention as there are no defences. As the shoreline rolls back the natural dune defence would increase, however the flood defences to the rear such as the sluices at North and South Low would be increasingly exposed. To retain these features the defences to either side would need to be extended, which could cause increasing squeeze of the saltmarsh area.

The Holy Island Causeway would need to be raised under this scenario, encouraging the northern entrance to close. The rest of the Holy Island hinterland would respond as with NAI, however without opening up of the low lying land there would be loss of the intertidal area, especially saltmarsh.

The defences within Budle Bay would be retained, which could lead to the loss of finer sediment from the bay and loss of upper saltmarsh. On Holy Island retention of the breakwater at the harbour would reduce erosion and retreat within the bay.

Epoch 1: Years 0 – 20 (2025)		Epoch 2: Years 20 – 50 (2055)		Epoch 3: Years 50 – 100 (2105)	
Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
Defences would remain.	Limited erosion and roll back of shoreline.	Defences would remain.	Limited erosion and roll back of shoreline.	Defences would remain.	Limited erosion of shoreline, rate increases with sea level rise. Part of Goswick Fishery lost

Unit 3

Chainage

46km

68km

Harkenss Rocks to Castle Point

Baseline management scenarios

No active

intervention

(NAI)

Scenario description

This scenario assumes that defences are no longer maintained and will therefore fail over time. Timing of exact defence failure cannot be deduced accurately. However a failure epoch can be determined.

Shoreline response

Man made defences only influence localised areas, where this is the case a present they hold the coastline and are delaying its response to the general pattern of erosion. Between Budle Bay and Seahouses the coast will continue to erode slowly affecting road access in the latter part of the SMP2 period. The reduced shelter from Islestone Rocks will cause a reduction in the width of the Bamburgh Dunes supplying sediment to adjacent frontages. The till cliffs north of Seahouses will continue to erode resulting in the loss of the road in the medium term. As the defence of Seahouses fail the coast will erode causing substantial loss to the town and harbour, however the overall shape of the coastline will be maintained with this headland still acting as a barrier. South of Seahouses the soft frontage will erode but only a short distance as it is in a stable condition. More significant could be increased flooding regularity of the floodplain behind the dunes, potentially creating saline lagoons and with an increasing tidal prism the opportunity of dune growth on the foreshore.

Erosion would result in the loss of the road to Beadnell Harbour in part during the first epoch and most of the front row of housing would be lost over the long term. The harbour and associated development would be lost over the next 100years, loss of the harbour structures would result in significant realignment of the north of Beadnell Bay resulting in the loss of substantial amounts of property, the recreational centre and parts of the caravan park.

At Low Newton sea level rise and defence failure could result in the coast stepping back considerably resulting in significant loss of property. To the south, as sea level rise reduces the influence of Emblestone Rocks, Chuck Bank will erode faster, the coastline will tend to straighten and there will be loss of both dunes and chalets. Within Embleton Bay the dunes will benefit from the sediment supply from the north and would roll back a short distance in response to sea level rise.

Epoch 1: Years 0 – 20 (2025)		Epoch 2: Years 20 – 50 (2055)		Epoch 3: Years 50 – 100 (2105)	
Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
The West Breakwater at Seahouses will be maintained but within the harbour defences will fail. Defences on the north-east frontage of Beadnell and the southern frontage of Beadnell Harbour will fail.	Limited erosion or roll back of shoreline.	The end of the West Pier at Seahouses will fail and within the harbour the frontage will continue to erode. The frontages of Beadnell and Beadnell Harbour will continue to erode. The sea wall at low Newton will also fail.	Increasing erosion and roll back of shoreline due to sea level rise.	The end of the West Pier at Seahouses will be maintained at the epoch 2 position and within the harbour the frontage will continue to erode. The frontages of Beadnell and Beadnell Harbour will continue to erode.	Increasing erosion and roll back of shoreline due to sea level rise.

With Present
Management
(WPM)

Scenario description

This scenario assumes that the current policy for the frontage is continued. This will usually involve maintaining defences to provide a similar level of protection to that provided at present and regularly inspecting and maintaining the defences.

Shoreline response

The principal difference to NAI is that the defences at the centres of population are maintained. At Seahouses the breakwater and seafront defences are maintained, however this would reduce the area of rock foreshore habitat. Maintaining the defences at Beadnell would protect properties and the shape of Beadnell Bay; in addition it would encourage and allow retention of a more natural dune frontage around the bay. The defences at Low Newton are presently being allowed to fail; maintenance of these structures would delay the loss of the village.

Epoch 1: Years 0 – 20 (2025)		Epoch 2: Years 20 – 50 (2055)		Epoch 3: Years 50 – 100 (2105)	
Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
Defences would remain.	Limited erosion or roll back of shoreline.	Defences would remain.	Increasing erosion and roll back of shoreline due to sea level rise.	Defences would remain.	Increasing erosion and roll back of shoreline due to sea level rise.

Unit 4

Chainage

68km

79.5km

Castle Point to Seaton Point

Baseline management scenarios

No active

intervention

(NAI)

Scenario description

This scenario assumes that defences are no longer maintained and will therefore fail over time. Timing of exact defence failure cannot be deduced accurately. However a failure epoch can be determined.

Shoreline response

The majority of this unit is comprised of continuous wave-cut rock platform backed by hard rock cliffs, only being interrupted by a short stretch of coastal till slope immediately south of Craster. South of Rumbling Kern until Seaton Point the backshore reduces in level to become a low till cliff but the rock platform foreshore is maintained. Slow erosion of these natural features will continue under this scenario.

At Craster the village is protected by several harbour structures, eventual loss of these features would result in significant loss of the village harbour front, the beach within the harbour and properties to the north and south. At Boulmer light revetments protect the village, under NAI this defence would be lost leading to loss of a significant number of properties and part of the road

Epoch 1: Years 0 – 20 (2025)
Epoch 2: Years 20 – 50 (2055)
Epoch 3: Years 50 – 100 (2105)
Defences
Natural coast

Defences would remain at Craster but fail at Boulmer.

Limited erosion of cliffs.

Defences
Natural coast

Defences would fail at Craster.

Limited erosion of cliffs.

Defences
Natural coast

All Defences have failed.

Limited erosion of cliffs.

With Present

Management

(WPM)

Scenario description

This scenario assumes that the current policy for the frontage is continued. This will usually involve maintaining defences to provide a similar level of protection to that provided at present and regularly inspecting and maintaining the defences.

Shoreline response

The principal difference between this scenario and that of No Active Intervention is that defences are maintained at Craster and Boulmer. At Craster the present structure would be maintained under present management, at Boulmer it would be appropriate to undertake minor works to the frontage to support the village. Additional structures would be necessary in the longer term to retain beach material, although in the longer term the success of this depends on beach behaviour. It is assumed that With Present Management would translate into holding the line for 50 years then implement some managed retreat of the frontage.

Epoch 1: Years 0 – 20 (2025)
Epoch 2: Years 20 – 50 (2055)
Epoch 3: Years 50 – 100 (2105)

Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
Defences would remain.	Limited erosion of cliffs	Defences would remain.	Limited erosion of cliffs	Defences would remain at Craster with some managed retreat at Boulmer.	Limited erosion of cliffs

Unit 5

Chainage

79.5km

97km

Seaton Point to Beacon Hill

Baseline management scenarios

No active

intervention

(NAI)

Scenario description

This scenario assumes that defences are no longer maintained and will therefore fail over time. Timing of exact defence failure cannot be deduced accurately. However a failure epoch can be determined.

Shoreline response

As much of the unit is undefended it will act the same as in the unconstrained scenario, however where defences do exist there will be local differences.

Foxton Bay will continue to erode and adjust as the influence of the rock platforms reduces with sea level rise and there will be an increased pressure for the coast to roll back. The defences at Foxton Hall would initially limit erosion but over the SMP period the hall could be threatened and various chalets at Seaton Point would be lost.

On the Alnmouth Beach frontage there are tank trap blocks that do not directly limit erosion but do reinforce dune development during accretion. There will continue to be variable erosion rates along this frontage especially in the area of the car park with the potential for a breach of the ridge protecting the golf course. This general erosive behaviour tends to be intermittent, recreating width for natural dune development and as erosion continues the dune tends to remain intact as the frontage erodes. As the tidal prism of the Aln increases and the defences on the northern side of the estuary fail there is likely to be movement of the dune nose north, increasing stability of the area in front of the southern part of the car park. On the northern side of the estuary mouth failure of the defences will result in the loss of the road, while within the estuary loss of defences will lead to increased flood risk to Alnmouth. Failure of the bank on the eastern side of the estuary south of the road bridge would allow for channel realignment and the possibility that the bridge would be outflanked and the road lost. Abandoning defences on the upper part of the estuary could put the sewerage treatment works at risk. Loss of the defences in the estuary would not increase the tidal prism in the short term but over the long term it will increase flows through the bridge and eroding land south of the bridge realigning the channel and putting pressure on the southern side of the estuary mouth.

South of the estuary the defences at Church Hill will fail in the second epoch leading to loss of the church and allowing the estuary mouth to migrate southwards. There would be an increasing tendency for sediment to enter the southern side of the estuary closing the channel behind Church Hill and reducing the existing area of saltmarsh.

The dunes to the south of the estuary would continue to erode back as would the frontage of the main bay. This will impact on the caravan park but

also allow natural development of dunes.

At the south of Alnmouth Bay the North Breakwater at Amble will continue to provide protection to the frontage into the third epoch even without any maintenance. However the dunes at the root of the breakwater are likely to breach in the second epoch creating a second channel into the estuary, potentially reducing navigation to the harbour and exposing the marina to increased wave energy. Within the estuary sea level rise would lead to increased flooding of the coastal road and a general increase in mudflats, squeezing the saltmarsh against the higher land. As the breakwater does fail this would increase exposure within the harbour coupled with failure of the south pier slightly earlier would lead to failure of other defences and erosion of the town frontage. Under this scenario use of Amble Harbour would become impossible leading to significant economic and socio-economic losses.

South of the Harbour defences at Pan Point and Island View would fail leading to loss of property and exposure of potentially contaminated land south of Pan Point. Further south erosion would continue without significant losses.

Epoch 1: Years 0 – 20 (2025)		Epoch 2: Years 20 – 50 (2055)		Epoch 3: Years 50 – 100 (2105)	
Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
Defences at Foxton Hall, eastern frontage of Alnmouth within the estuary fail.	Limited erosion of dunes within Foxton Bay, in front of golf course north of Alnmouth, within the Aln Estuary	Defences at on the north side of the Aln Estuary mouth, at Church Hill and within the Coquet Estuary fail.	Limited Erosion of most of the natural coast, dunes at the root of the Amble North Breakwater may breach.	Amble North Breakwater may start to fail further exposing the estuary.	Greater erosion of the natural coast.

With Present Management (WPM)

Scenario description

This scenario assumes that the current policy for the frontage is continued. This will usually involve maintaining defences to provide a similar level of protection to that provided at present and regularly inspecting and maintaining the defences.

Shoreline response

The majority of the unit would behave and be managed in the same way to the No Active Intervention scenario, the principle differences would occur at Alnmouth and Amble, at Foxton Bay there is no policy to retain the defences so the No Active Intervention scenario applies.

The strategy for Alnmouth beach identified no justification for the maintenance of defences; however there have been works to manage the frontage. Without a definitive policy it is assumed that it is a policy of adaptation to NAI with loss of the golf course to flooding. Within the estuary the defences to the town would be retained but a policy of withdrawal of defences to agricultural land, which would increase the tidal prism. With no intervention to the south side of the estuary mouth it would widen with erosion leading to the loss of Church Hill and sediment would accumulate in the southern part of the estuary.

The main frontage of Alnmouth bay would respond as for the NAI scenario. At Amble all defences would be retained and the breach of the dunes to the north of the breakwater would need to be addressed. To the south of Amble the policy at Pan Point is to Hold The Line while to the south it is NAI.

Epoch 1: Years 0 – 20 (2025)		Epoch 2: Years 20 – 50 (2055)		Epoch 3: Years 50 – 100 (2105)	
Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
Defences would remain.	Limited erosion of the coast.	Defences at Church Hill fail	Limited erosion of the coast.	Defences would remain.	Limited but increased erosion of the coast.

Unit 6

Chainage

97km

109km

Beacon Hill to Snab Point

Baseline management scenarios

No active

intervention

(NAI)

Scenario description

This scenario assumes that defences are no longer maintained and will therefore fail over time. Timing of exact defence failure cannot be deduced accurately. However a failure epoch can be determined.

Shoreline response

This scenario is similar to that of the unconstrained situation and where there are areas of defence the onset of erosion would be delayed to some extent. At Low Hauxley there would be loss of the community and the properties to the north, while at Cresswell sea front properties and the convenience store would be lost as well as the road to Snab Point.

Epoch 1: Years 0 – 20 (2025)
Defences

Defences at Cresswell fail.

Natural coast

Limited erosion of the coast.

Epoch 2: Years 20 – 50 (2055)
Defences

Defences at Low Hauxley fail.

Natural coast

Limited erosion of the coast.

Epoch 3: Years 50 – 100 (2105)
Defences

All defences have failed.

Natural coast

Limited erosion of the coast.

With Present

Management

(WPM)

Scenario description

This scenario assumes that the current policy for the frontage is continued. This will usually involve maintaining defences to provide a similar level of protection to that provided at present and regularly inspecting and maintaining the defences.

Shoreline response

Over the majority of the unit the scenario is the same as NAI, except for at Low Hauxley and Cresswell. At Low Hauxley the village would be retained but access would be cut in the long term unless action was undertaken to protect the coastal road. In the longer term there may be need to defend the back of Low Hauxley to prevent flooding and to extend the defence of the frontage to the north. This would mean that Low Hauxley is a distinct promontory raising the question of the long term sustainability of the village.

Maintaining the dune and sluices to the hinterland of Druridge bay is not unsustainable and will give additional biodiversity opportunities. At Cresswell the village would be protected, however the defences do impose on the geological value of designated area, the road to the south is expected to be lost

Epoch 1: Years 0 – 20 (2025)		Epoch 2: Years 20 – 50 (2055)		Epoch 3: Years 50 – 100 (2105)	
Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
Defences would remain.	Limited erosion of the coast.	Defences would remain.	Limited erosion of the coast.	Defences would remain, additional defences may be required at Low Hauxley.	Limited erosion of the coast.

Unit 7

Chainage

109km

113.5km

Snab Point to Beacon Point

Baseline management scenarios

No active

intervention
(NAI)

Scenario description

This scenario assumes that defences are no longer maintained and will therefore fail over time. Timing of exact defence failure cannot be deduced accurately. However a failure epoch can be determined.

Shoreline response

With this scenario the majority of the bay would continue to act in an unconstrained way, only the defences to the power station would have an impact. The revetment will fail but would still maintain significant influence on the frontage with of erosion only occurring in epoch 3 (50m).

Epoch 1: Years 0 – 20 (2025)
Epoch 2: Years 20 – 50 (2055)
Epoch 3: Years 50 – 100 (2105)
Defences
Natural coast
Defences
Natural coast
Defences
Natural coast

Defences would remain.

Limited erosion of the coast.

Defences would remain.

Limited erosion of the coast.

Defences at the Power Station fail.

Limited erosion of the coast.

With Present
Management
(WPM)

Scenario description

This scenario assumes that the current policy for the frontage is continued. This will usually involve maintaining defences to provide a similar level of protection to that provided at present and regularly inspecting and maintaining the defences.

Shoreline response

Within Lynemouth bay the only difference of this scenario to NAI would be that the defences to the power station would be maintained while the coast to either side is allowed to retreat.

Epoch 1: Years 0 – 20 (2025)
Epoch 2: Years 20 – 50 (2055)
Epoch 3: Years 50 – 100 (2105)
Defences
Natural coast
Defences
Natural coast
Defences
Natural coast

Defences would remain.

Limited erosion of the coast.

Defences would remain.

Limited erosion of the coast.

Defences would remain.

Limited erosion of the coast.

Unit 8

Chainage

113.5km

130km

Beacon Point to Seaton Sluice

Baseline management scenarios

No active

intervention
(NAI)

Scenario description

This scenario assumes that defences are no longer maintained and will therefore fail over time. Timing of exact defence failure cannot be deduced accurately. However a failure epoch can be determined. The existing beach and dune management activities such as sand recycling and dune restoration at South Blyth Beach would cease.

Shoreline response

At first the shoreline would behave very similar to at present with the first noticeable signs of change occurring at South Blyth Beach where dunes would be damaged over the winter period. Over time large sections of the dunes would be eroded and the threat of breaching and flooding of the low lying hinterland would increase. undefended cliffs would continue to erode at rates controlled by their lithology.

The rock breakwaters in Sandy Bay would become progressively less effective as they are not maintained. The larger defensive structures such as a Newbiggin, the revetment at the north of Cambois Bay and the sea wall at Blyth Links would remain longer into epoch 2 but will ultimately fail. At Newbiggin this could cause rapid recession of the coastline causing flooding of the frontage.

The piers at Blyth would still maintain some control over the coastline form even if they are not maintained due to their size. However breaching and outflanking of the structures would occur affecting the sustainability of Blyth Harbour, North Blyth and Blyth Town due to some coastal erosion and increased flood risk.

Erosion of the coast between Beacon Point and Newbiggin Point is likely to threaten the golf course. Recession of Newbiggin Headland is likely to be relatively small but could lead to long term inundation of the town and loss of the church graveyard. Slow recession will also occur at Spital Point and therefore it will remain a control point for the coast to the south. Cliff recession will affect Sandy Bay Caravan Park and the undefended section to the north. Erosion will also be a problem in Cambois Bay, close to the river mouth in the northern section properties will be at risk while to the south the access road, mineral railway and houses and industrial assets north of Blyth would be at risk.

Further south a breach would be caused into South Harbour changing the configuration of the harbour mouth. Failure of the Promenade at Blyth Links would result in loss of land but at Hartley Links there is sufficient accommodation space to enable landward migration without exposing the Links Road to erosion.

Epoch 1: Years 0 – 20 (2025)		Epoch 2: Years 20 – 50 (2055)		Epoch 3: Years 50 – 100 (2105)	
Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
Defences at North Blyth (Ch 112.5km) begin to fail and Defences in eastern Seaton Sluice	Erosion, rate dependant on lithology and type of geomorphology.	Defences at Newbiggin begin to fail, Piers at Blyth and the South Blyth frontage begins to fail allowing erosion, and defences at western Seaton Sluice fail.	Erosion, rate dependant on lithology and type of geomorphology.	Further erosion of Newbiggin frontage as defences fails completely. Defences at Sandy Bay fail exposing caravan park to erosion. Revetment at Cambois Bay begins to fail.	Erosion, rate dependant on lithology and type of geomorphology.

With Present Management (WPM)

Scenario description

This scenario assumes that the current policy for the frontage is continued. This will usually involve maintaining defences to provide a similar level of protection to that provided at present and regularly inspecting and maintaining the defences.

Shoreline response

The presently undefended sections would continue to erode however local management activities will be sustained to slow the rate of recession and ensure that processes are controlled. At Newbiggin it is assumed that the present scheme would be sustained and that defences would be maintained at Church Point, however this scenario does allow for erosion at Newbiggin Moor which could expose the town to flooding in the long term and the erosion during the SMP period.

In Sandy Bay and the northern section of Cambois Bay coastal evolution will differ little from NAI although local defences will slow erosion rates in their vicinity. Maintaining defences further south will reduce recession rates and prevent loss of assets, it will also prevent major changes to the configuration of the harbour mouth as breaching through South Harbour is prevented. Blyth Links promenade will be maintained protecting assets behind, although the alignment of this frontage will make it more vulnerable to damage as sea level rises.

Epoch 1: Years 0 – 20 (2025)		Epoch 2: Years 20 – 50 (2055)		Epoch 3: Years 50 – 100 (2105)	
Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
Defences would remain.	Erosion, rate dependant on lithology and type of geomorphology.	Defences would remain.	Erosion, rate dependant on lithology and type of geomorphology.	Defences would remain.	Erosion, rate dependant on lithology and type of geomorphology.

Unit 9

Chainage

130km

145.5km

Seaton Sluice to River Tyne

Baseline management scenarios

No active

intervention

(NAI)

Scenario description

This scenario assumes that defences are no longer maintained and will therefore fail over time. Timing of exact defence failure cannot be deduced accurately. However a failure epoch can be determined.

Shoreline response

The existing coastal defences are likely to continue to exert a degree of influence on coastal behaviour during the first epoch even if they are not maintained. Over longer timescales cliff erosion would recommence, at the rock headlands rates of erosion would be low however where defences presently front sea cliffs or coastal slopes with softer lithology (Whitley Bay) recession would be more rapid and extend further inland. The headlands would still exert control on the shape of the coastline and sediment transport.

Tynemouth North Pier is likely to exert influence on the coast and estuary mouth without maintenance for the first two epochs, sheltering the frontage to Fish Quay. Over the long term failure of this defence would lead to greater wave energy within the estuary and when quay walls fail loss of the reclaimed land upon which the quays were created.

Epoch 1: Years 0 – 20 (2025)		Epoch 2: Years 20 – 50 (2055)		Epoch 3: Years 50 – 100 (2105)	
Defences	Natural coast	Defences	Natural coast	Defences	Natural coast
Defences in eastern Seaton Sluice around Rocky Island fail. In northern Whitley Bay begin to fail	Erosion, rate dependant on lithology and type of geomorphology.	Defences in Collywell Bay, at the St Mary's Island headland, the rest of Whitley Bay, most of Cullercoats Bay except for the South Pier, at Short Sands fail, at Tynemouth Castle cliffs and within the River Tyne fail. Tynemouth North Pier begins to fail but retains influence.	Erosion, rate dependant on lithology and type of geomorphology.	Erosion where defences have failed, Tynemouth North Pier fails to such an extent that its influence on the coast is lost.	Erosion, rate dependant on lithology and type of geomorphology.

With Present
Management
(WPM)

Scenario description

This scenario assumes that the current policy for the frontage is continued. This will usually involve maintaining defences to provide a similar level of protection to that provided at present and regularly inspecting and maintaining the defences.

Shoreline response

As the majority of the shoreline is defended by man made structures and other management activities it would be maintained at its present position under this scenario. Erosion would continue to occur at the limited undefended areas such as the cliffs north of the St Mary's Island lighthouse and in front of the Whitley Links golf course.

The Tynemouth North Pier also acts to control the shape of the coastline, over the long term the beaches fronting defences would have a tendency to lower.

Epoch 1: Years 0 – 20 (2025)

Defences

Defences would remain.

Natural coast

Erosion, rate dependant on lithology and type of geomorphology.

Epoch 2: Years 20 – 50 (2055)

Defences

Defences would remain.

Natural coast

Erosion, rate dependant on lithology and type of geomorphology.

Epoch 3: Years 50 – 100 (2105)

Defences

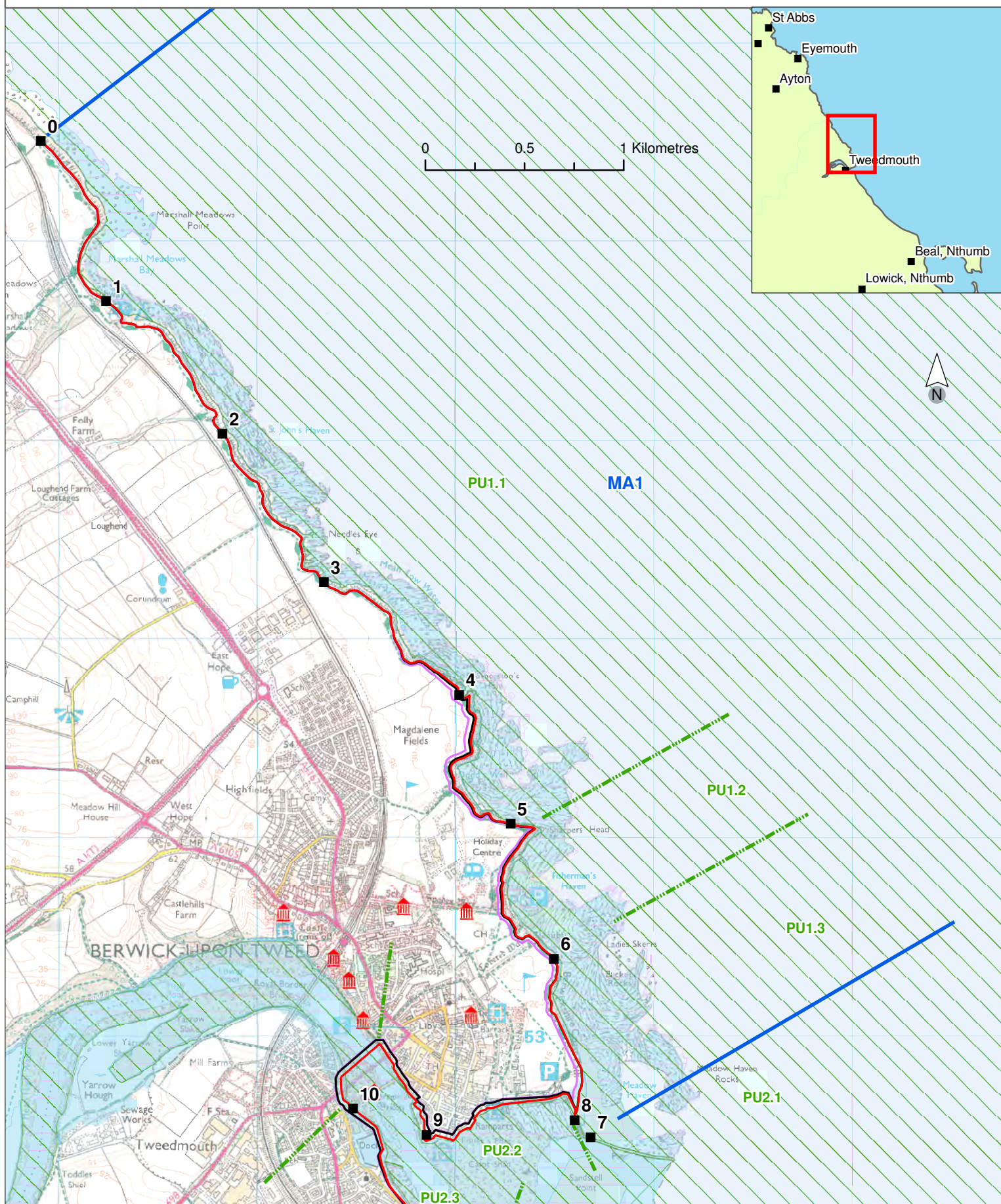
Defences would remain.

Natural coast

Erosion, rate dependant on lithology and type of geomorphology.

Policy Development Zone 1 - Scottish Border to Holy Island

Management Area 1 - North of Berwick (Ch 0 to 7.5)



Predicted Shoreline Position with No Active Intervention

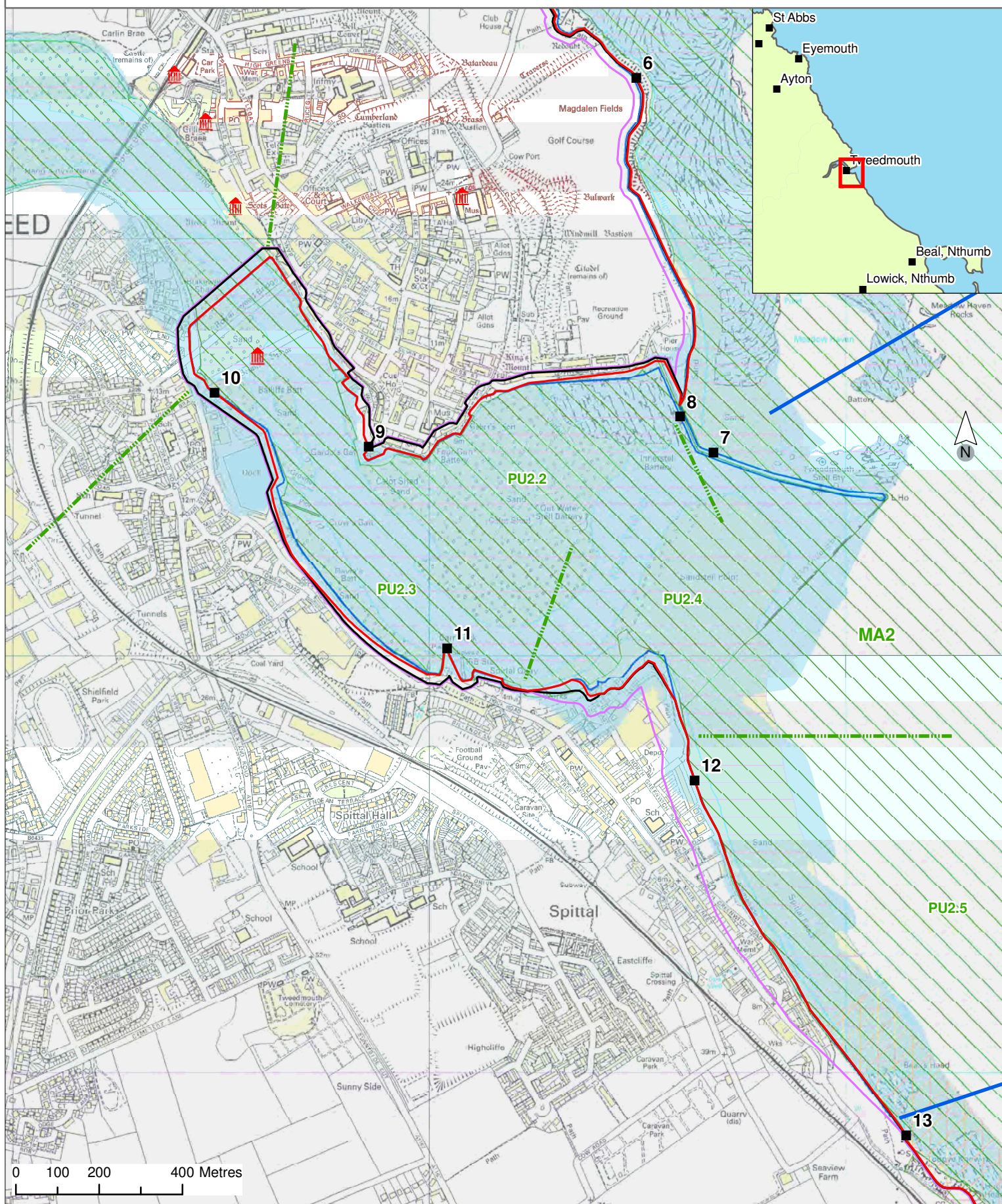
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 1 - Scottish Border to Holy Island Management Area 2 - Tweed Estuary (Ch 7.5 to 13)



Predicted Shoreline Position with No Active Intervention

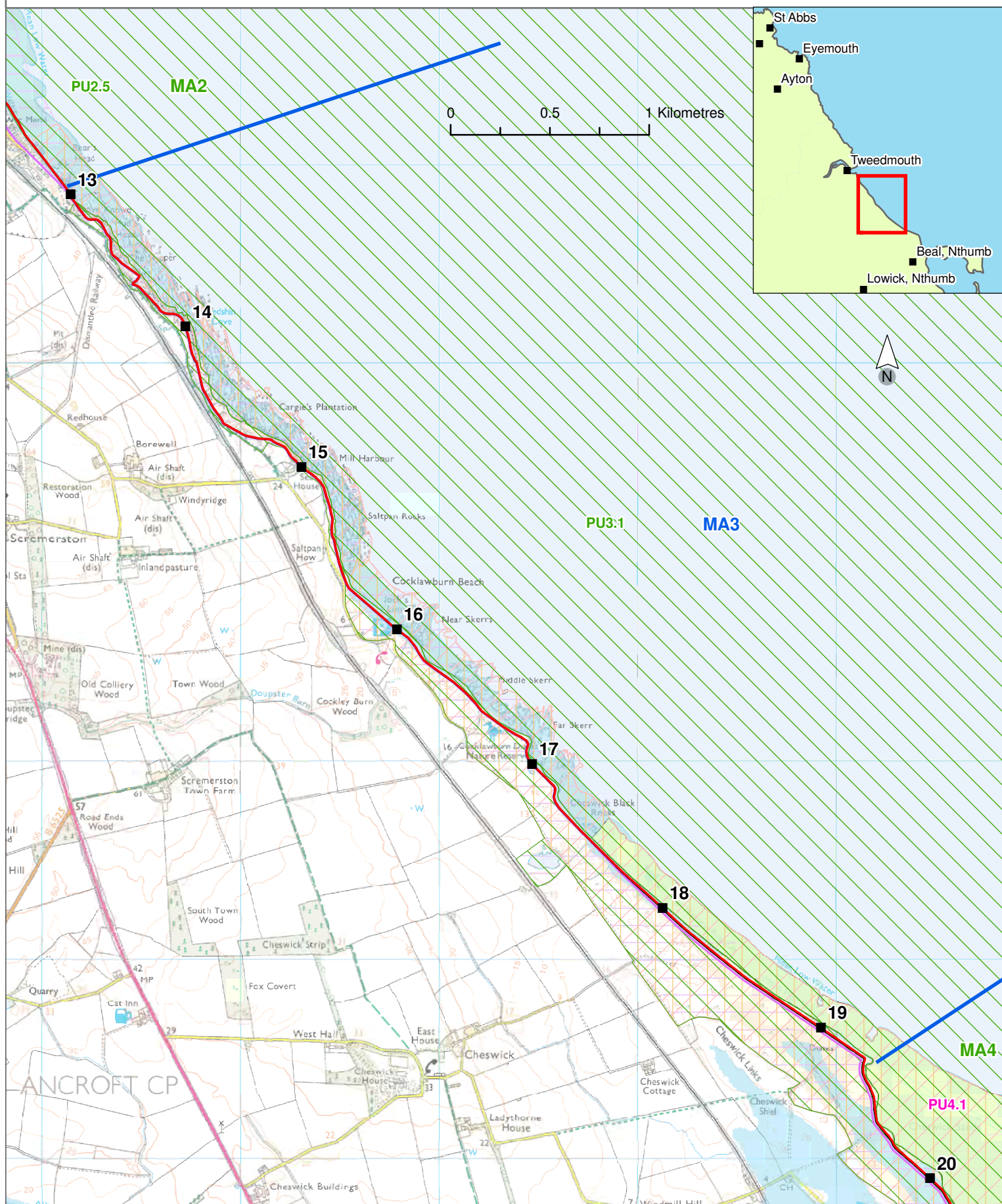
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 1 - Scottish Border to Holy Island Management Area 3 - Scremerston Cliffs (Ch 13 to 19.5)



Predicted Shoreline Position with No Active Intervention

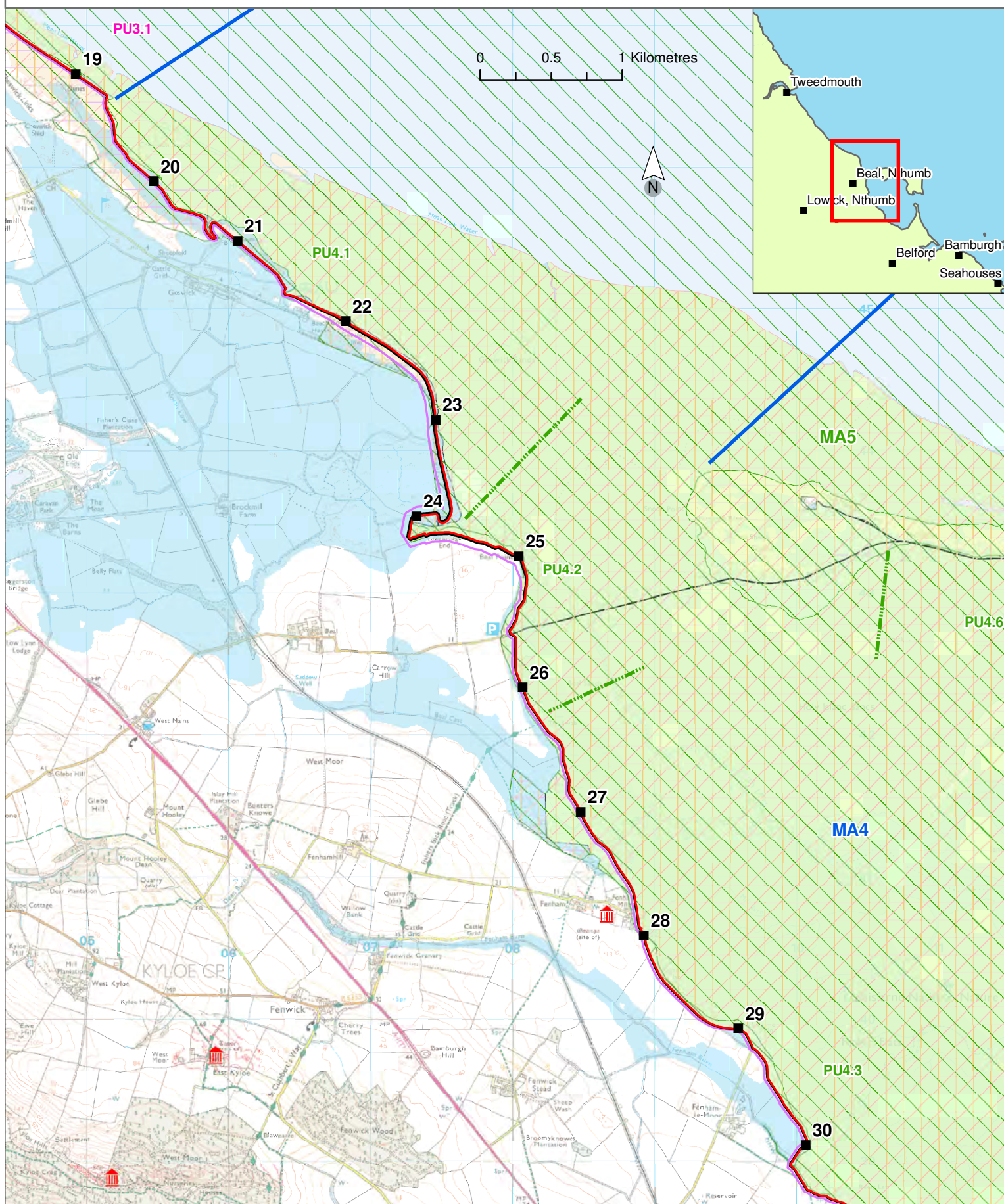
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 1 - Scottish Border to Holy Island
Management Area 4 - Holy Island Hinterland (Ch 19.5 to 44.5; Map1)



**Predicted Shoreline Position
with No Active Intervention**

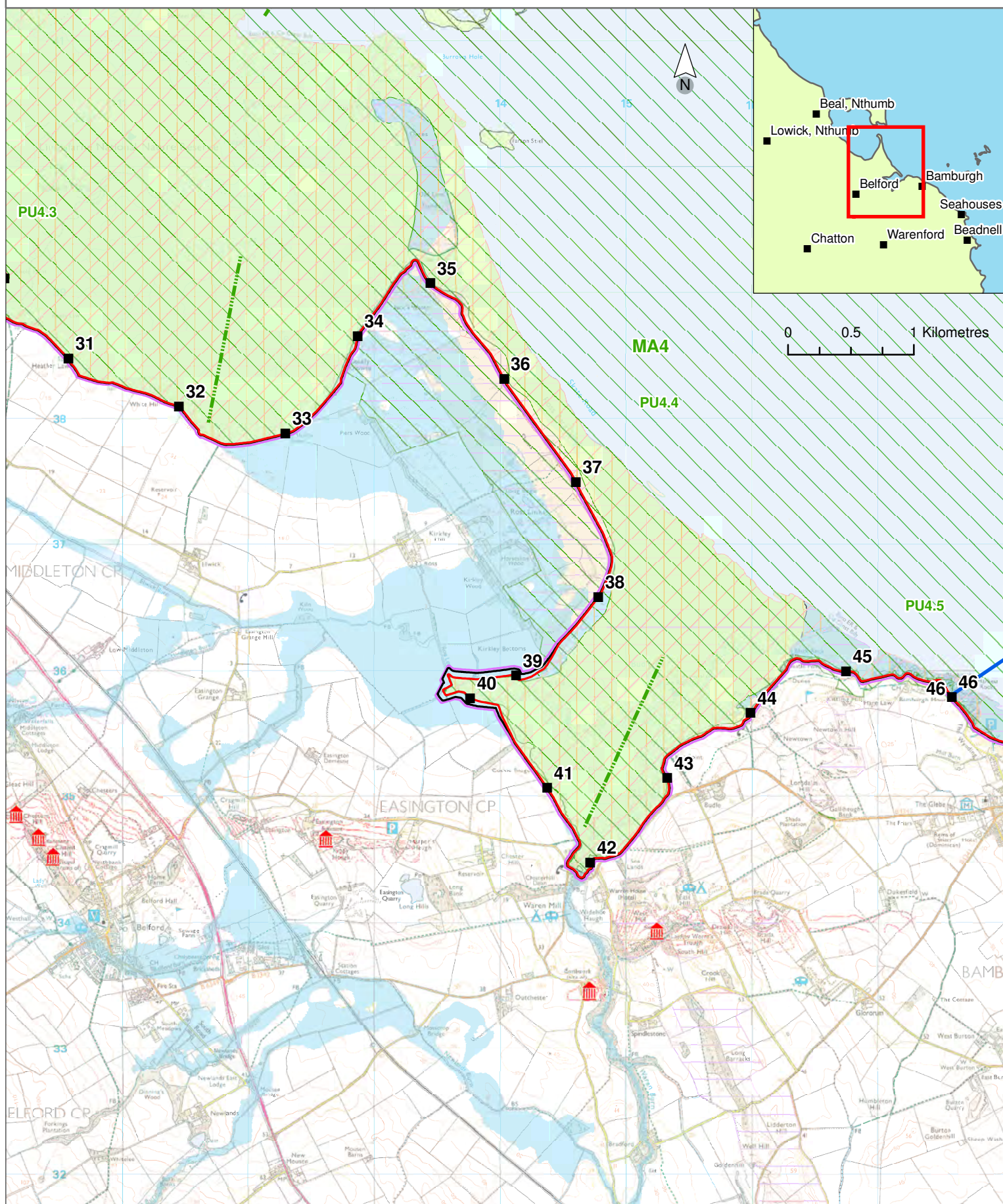
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 1 - Scottish Border to Holy Island
Management Area 4 - Holy Island Hinterland (Ch 19.5 to 44.5; Map2)



**Predicted Shoreline Position
with No Active Intervention**

- 20 Years
- 50 Years
- 100 Years

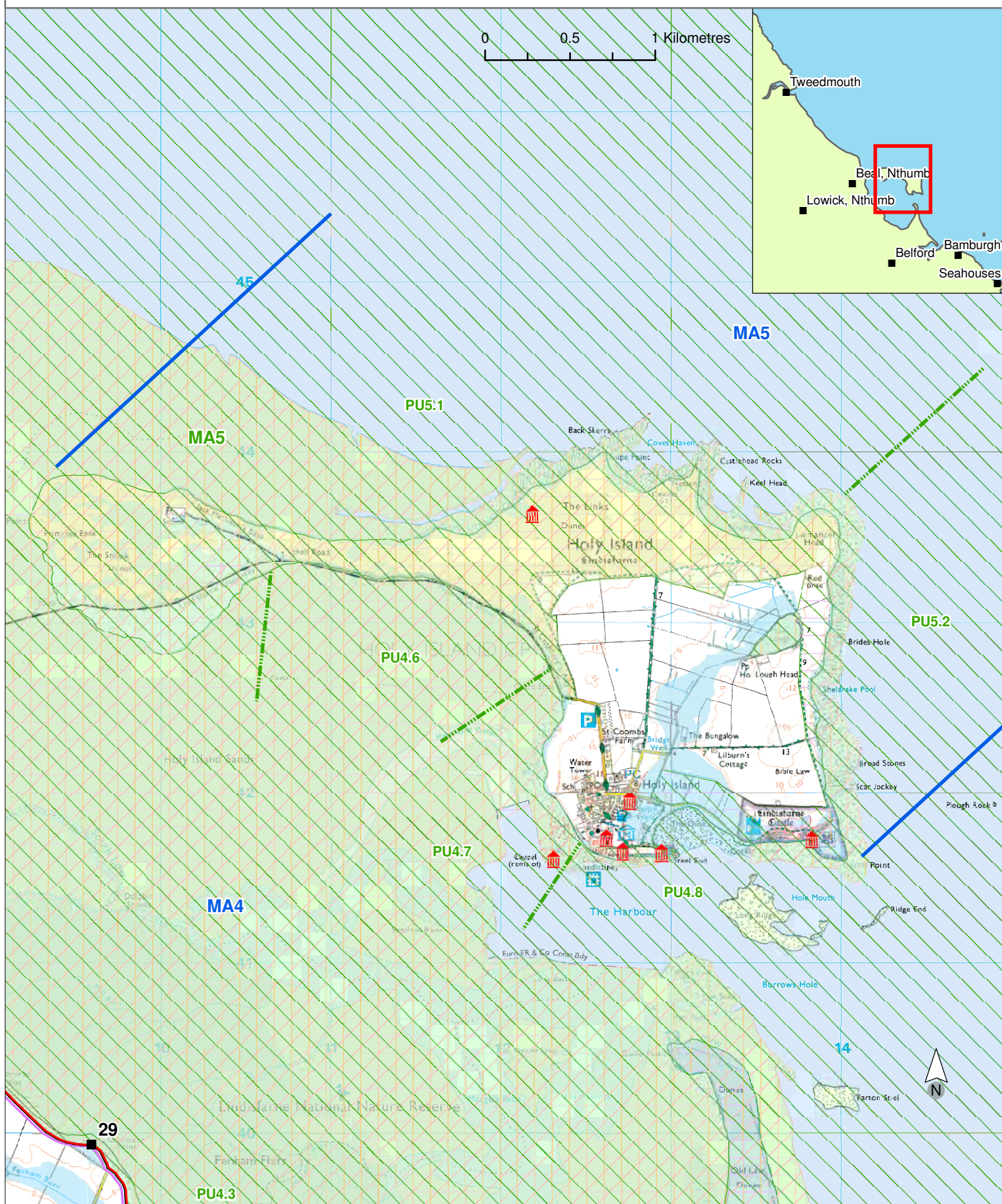
- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 1 - Scottish Border to Holy Island

Management Area 5 - Holy Island North and East



Predicted Shoreline Position with No Active Intervention

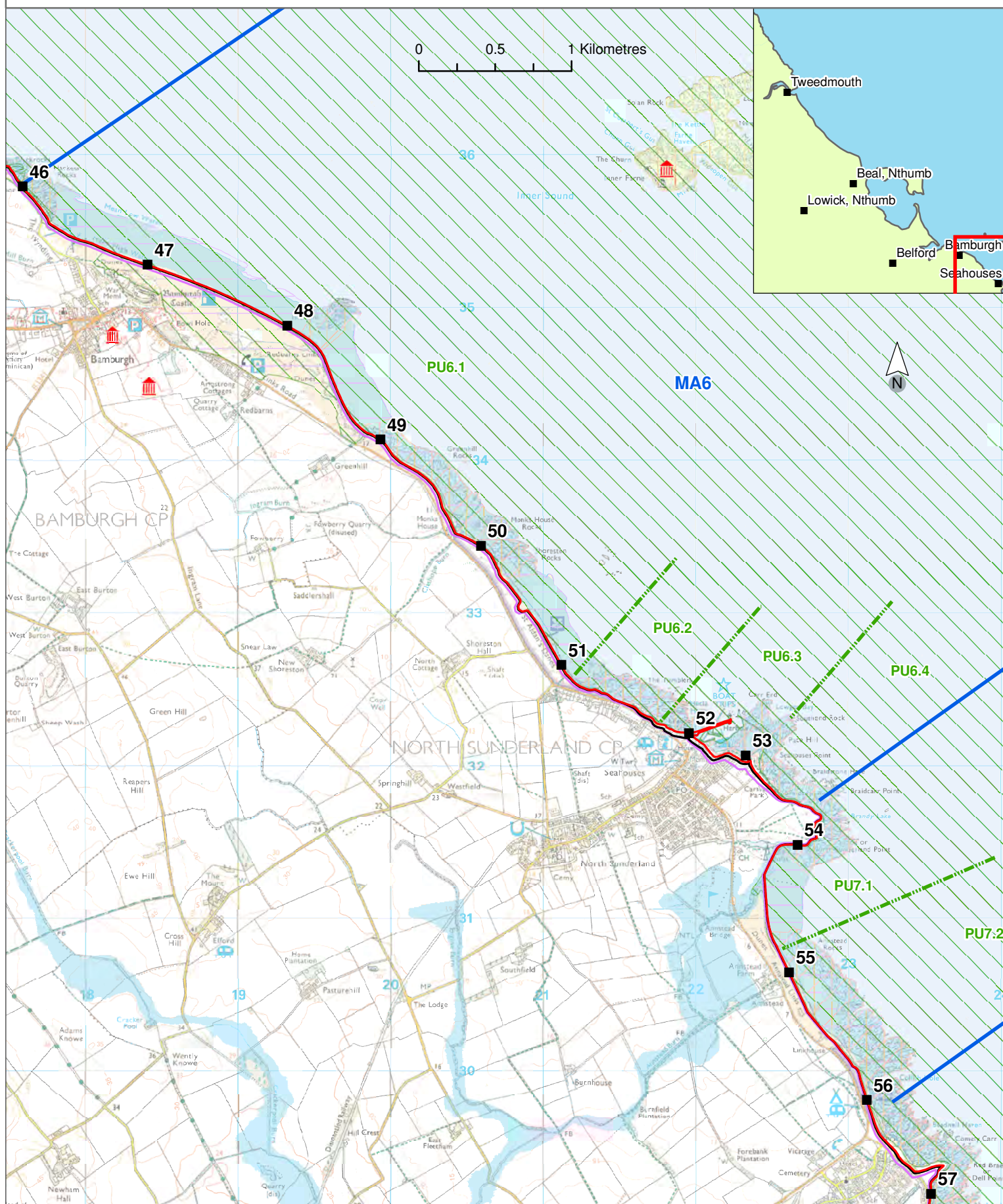
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 2 - Bamburgh to Boulmer
Management Area 6 - Budle Bay to Seahouses (Ch 46 to 53.5)



**Predicted Shoreline Position
with No Active Intervention**

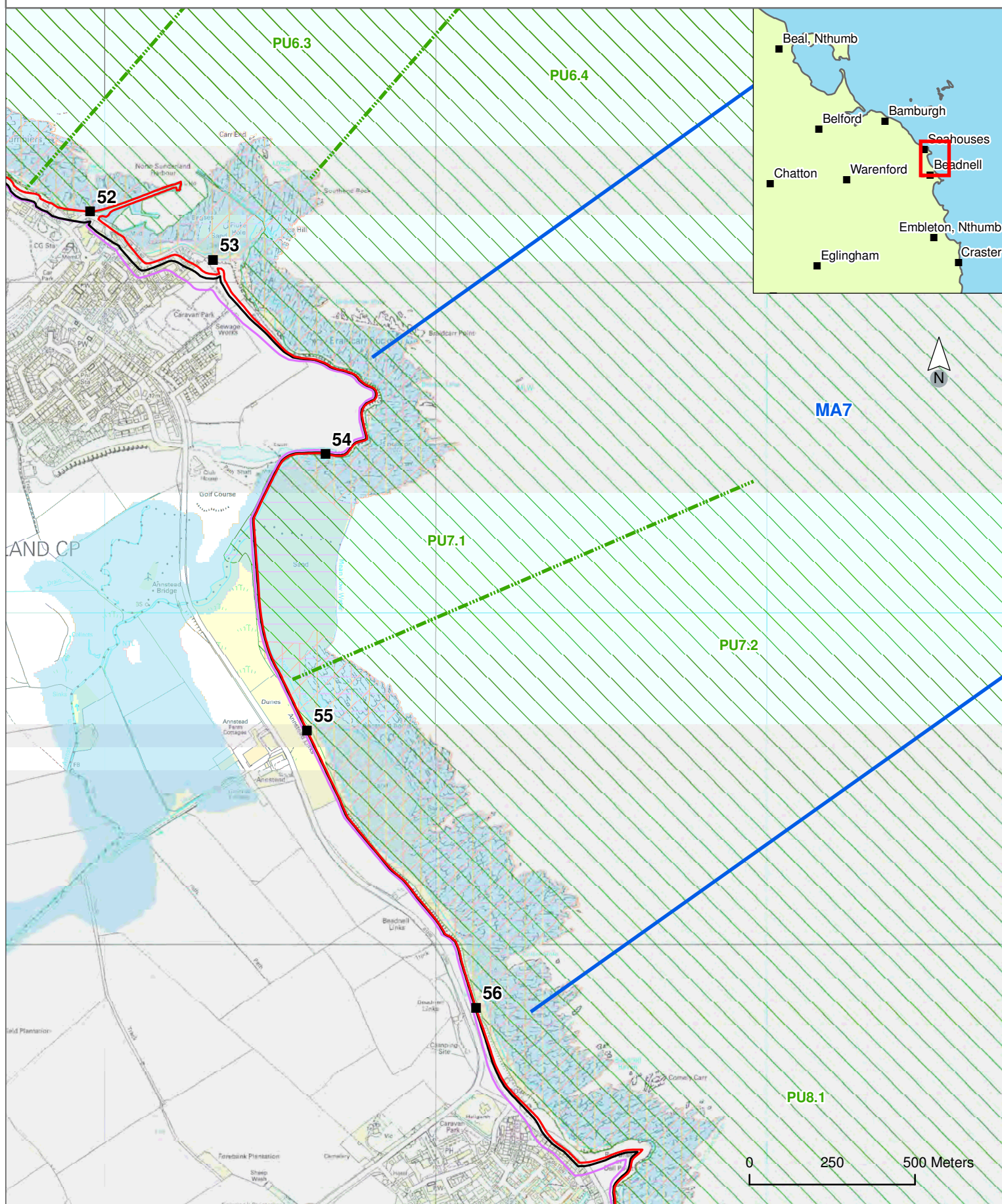
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units









Policy Development Zone 2 - Bamburgh to Boulmer
Management Area 7 - Seahouses to Beadnell (Ch 53.5 to 56)



Predicted Shoreline Position with No Active Intervention

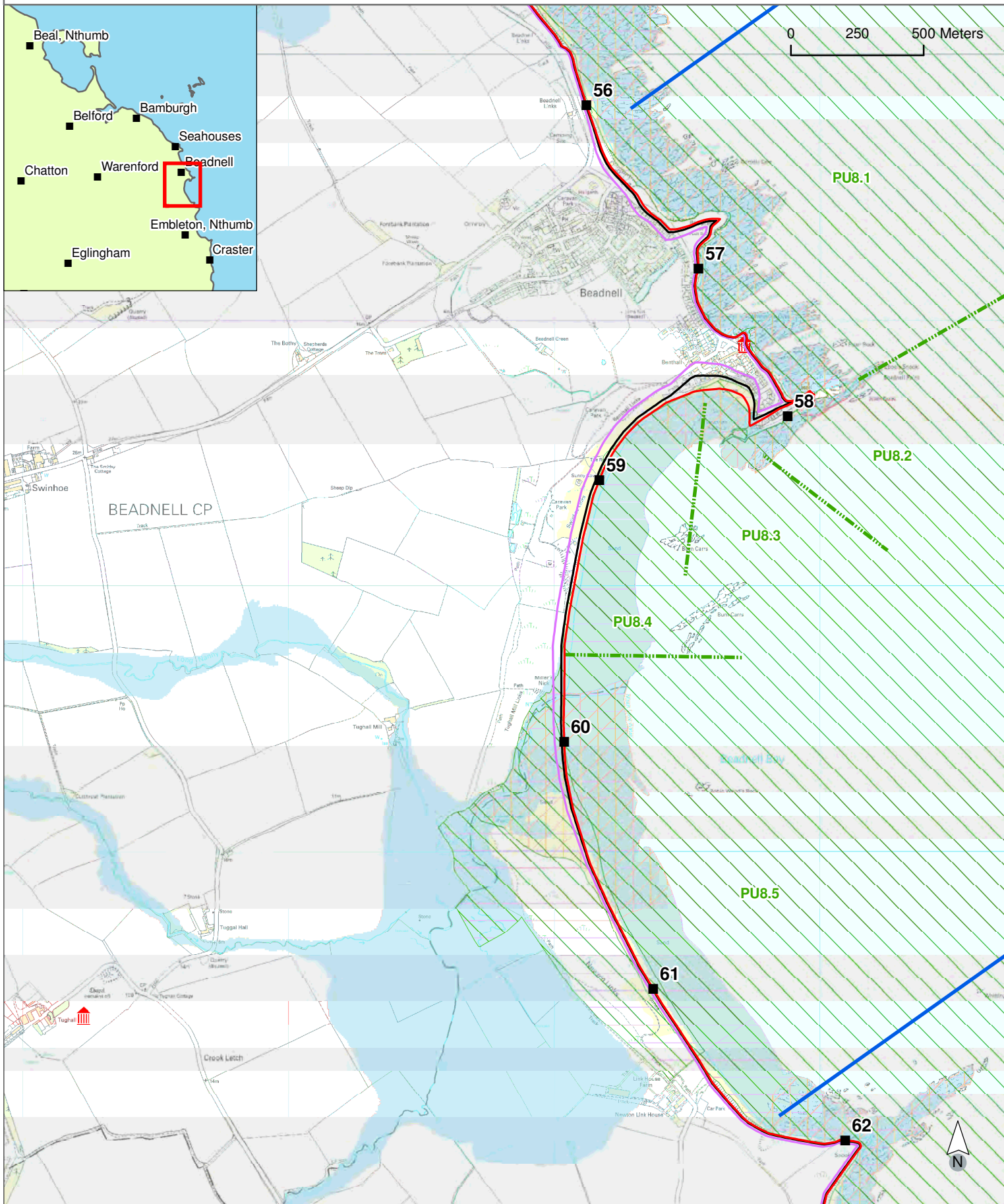
— 20 Years
— 50 Years
— 100 Years

-  SPA
-  RAMSAR
-  SAC
-  SSSI
-  NNR

-  Scheduled Ancient Monuments
-  EA Flood Zone - Sept 07
-  Management Areas
-  Policy Units



Policy Development Zone 2 - Bamburgh to Boulmer Management Area 8 - Beadnell and Beadnell Bay (Ch 56 to 62)



Predicted Shoreline Position with No Active Intervention

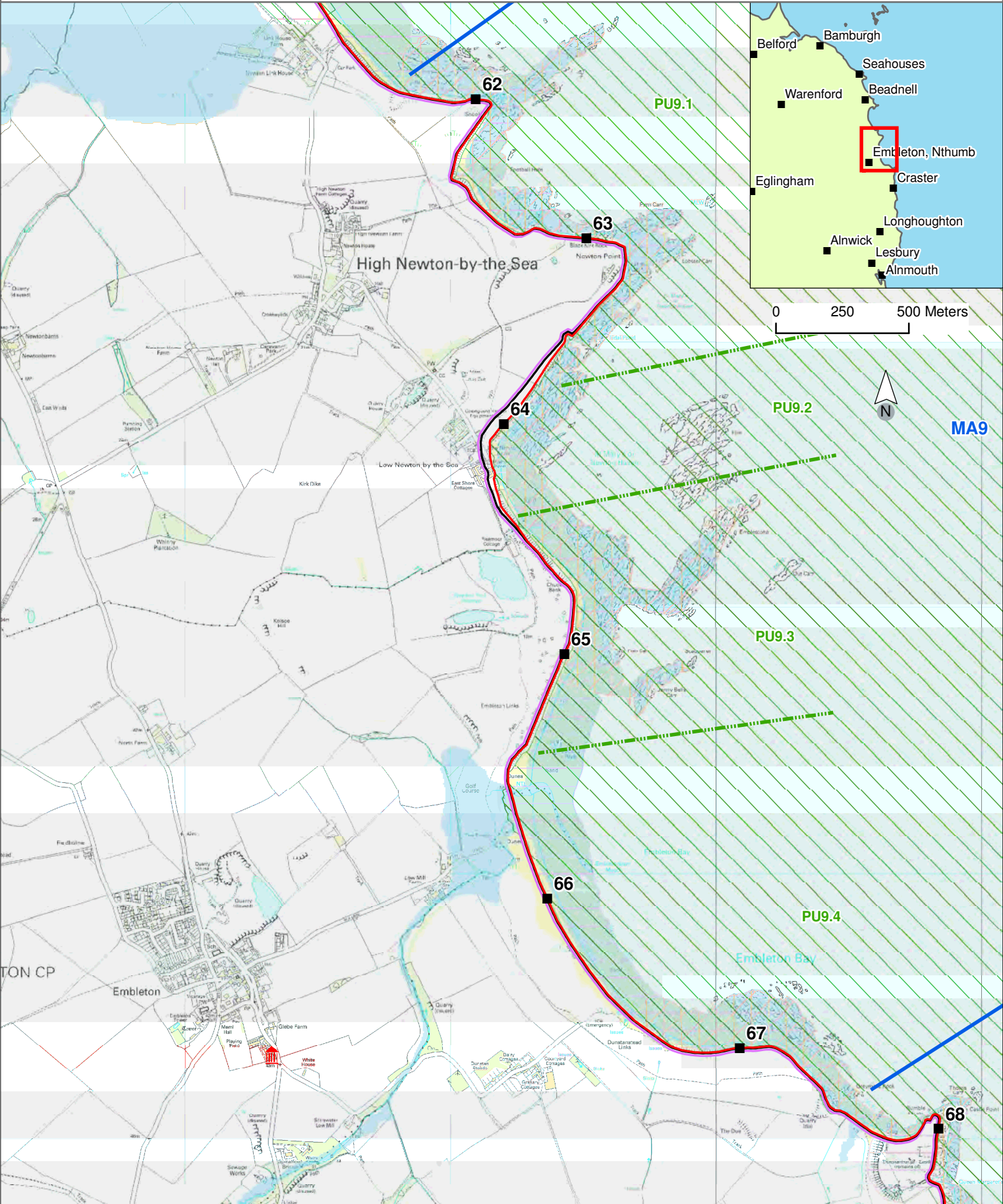
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 2 - Bamburgh to Boulmer Management Area 9 - Embleton Bay (Ch 62 to 68)



Predicted Shoreline Position with No Active Intervention

- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 2 - Bamburgh to Boulmer Management Area 10 - Castle Rock to Boulmer (Ch 68 to 77)



Predicted Shoreline Position with No Active Intervention

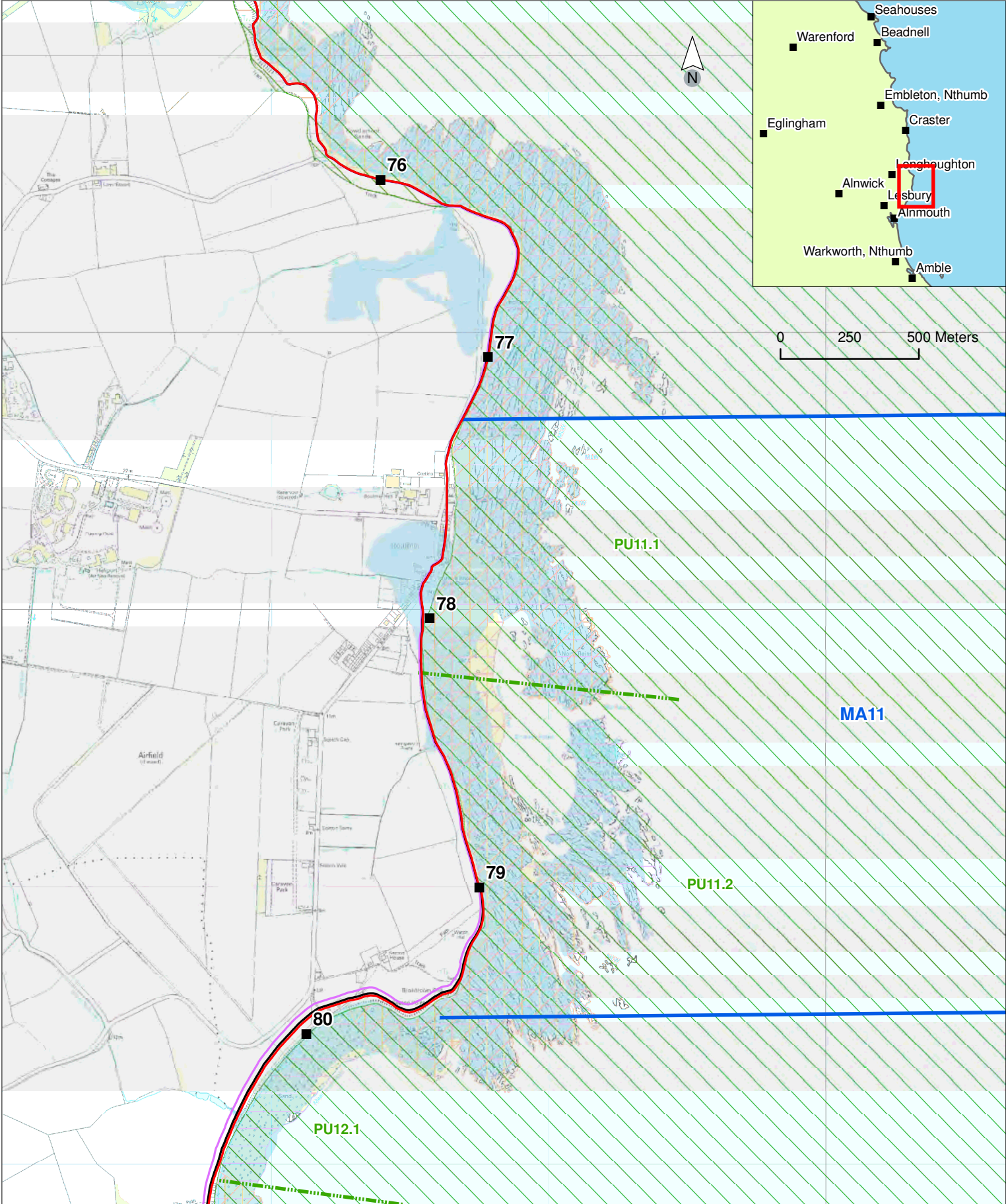
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 2 - Bamburgh to Boulmer
 Management Area 11 - Boulmer to Seaton Point (Ch 77 to 79.5)



Predicted Shoreline Position
 with No Active Intervention

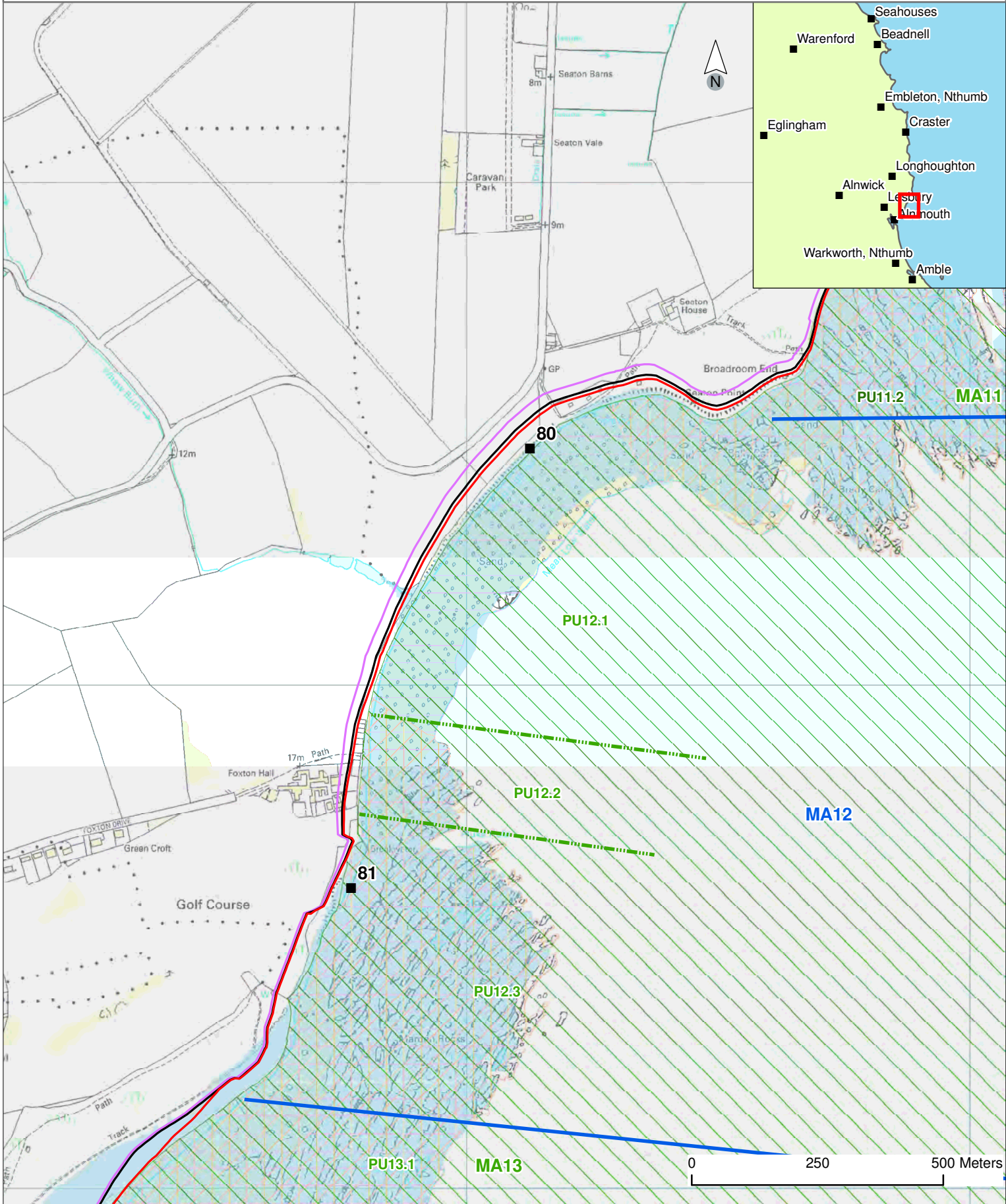
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 3 - Seaton Point to Beacon Hill
Management Area 12 - Foxhole Bay (Ch 79.5 to 81.5)



**Predicted Shoreline Position
with No Active Intervention**

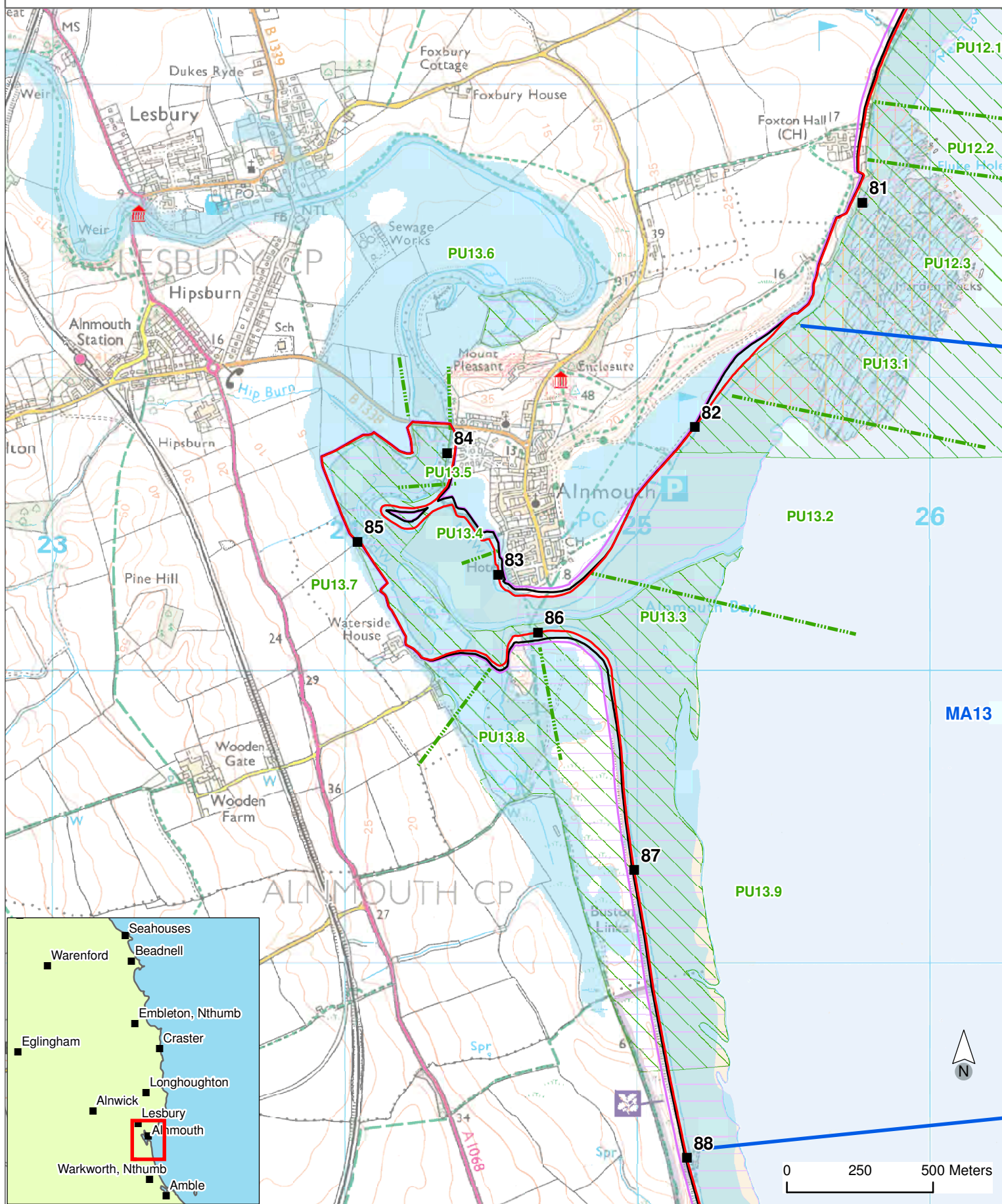
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 3 - Seaton Point to Beacon Hill Management Area 13 - Alnmouth Bay (Ch 81.5 to 85.5)



Predicted Shoreline Position with No Active Intervention

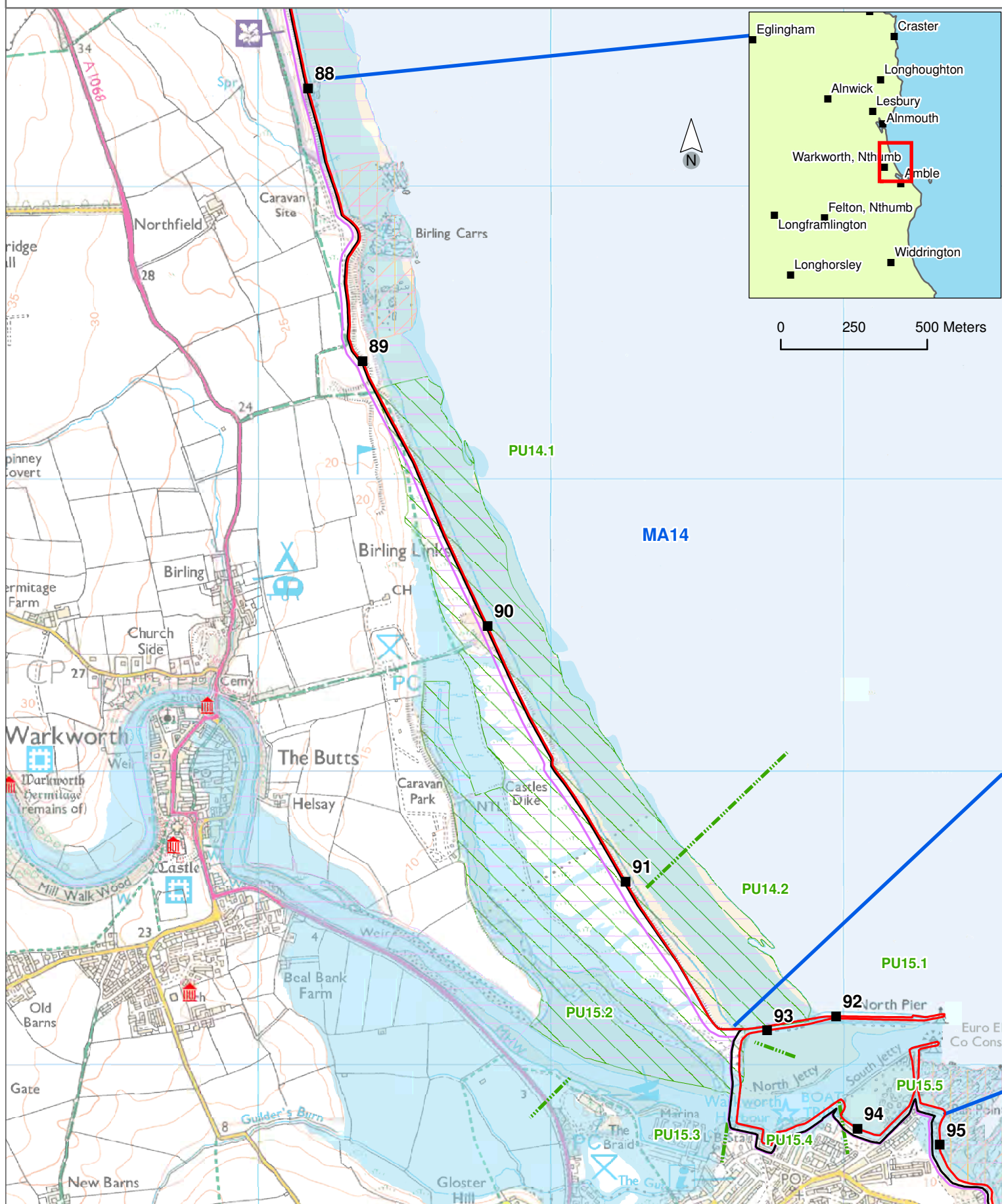
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 3 - Seaton Point to Beacon Hill Management Area 14 - Birling Links (Ch 85.5 to 92)



Predicted Shoreline Position with No Active Intervention

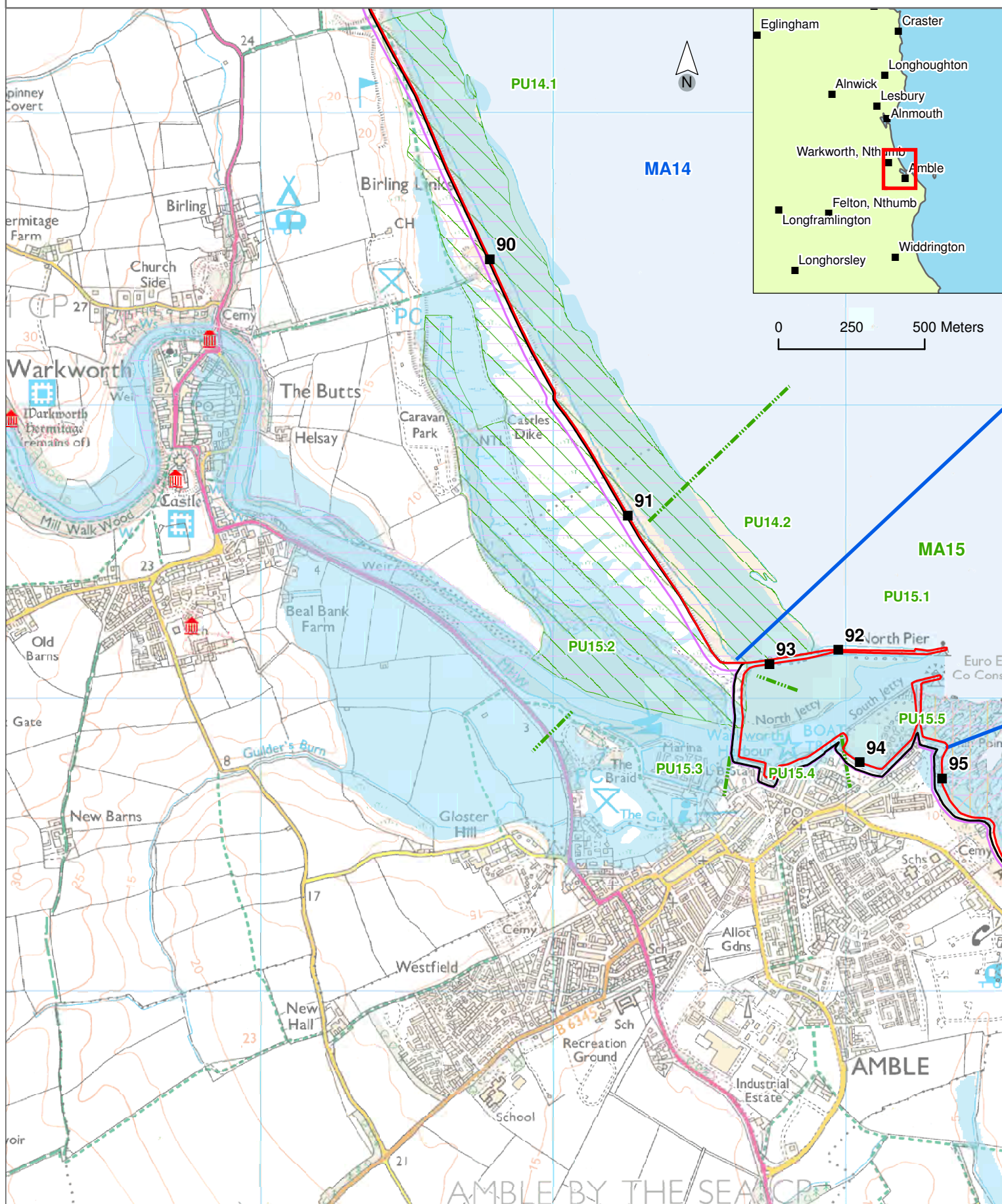
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 3 - Seaton Point to Beacon Hill Management Area 15 - Amble (Ch 92 to 94.5)



Predicted Shoreline Position with No Active Intervention

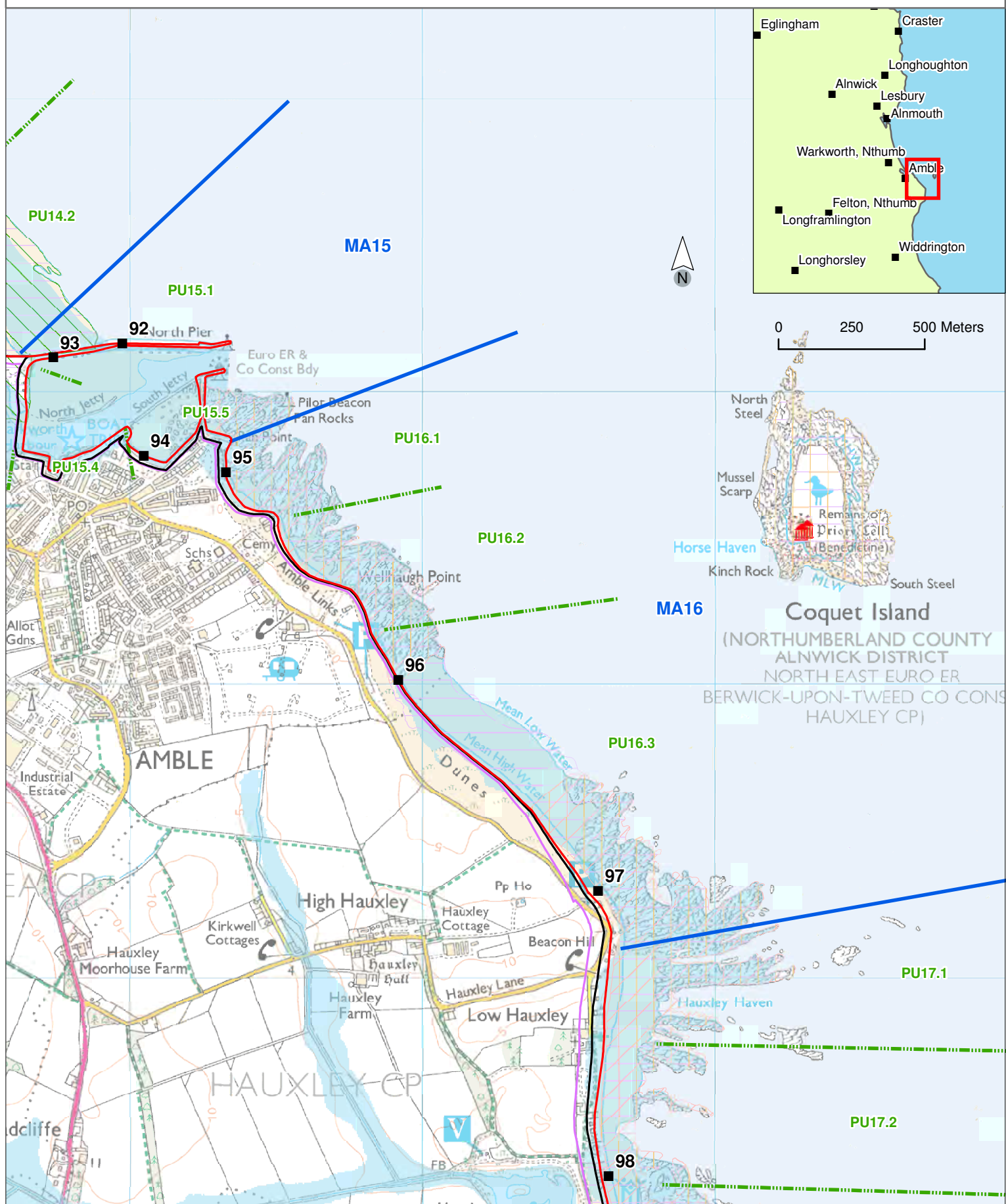
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 3 - Seaton Point to Beacon Hill
Management Area 16 - South Amble (Ch 94.5 to 97)



**Predicted Shoreline Position
with No Active Intervention**

- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 4 - Seaton Point to Beacon Hill
Management Area 17 - Beacon Hill to Creswell (Ch 97 to 108)



**Predicted Shoreline Position
with No Active Intervention**

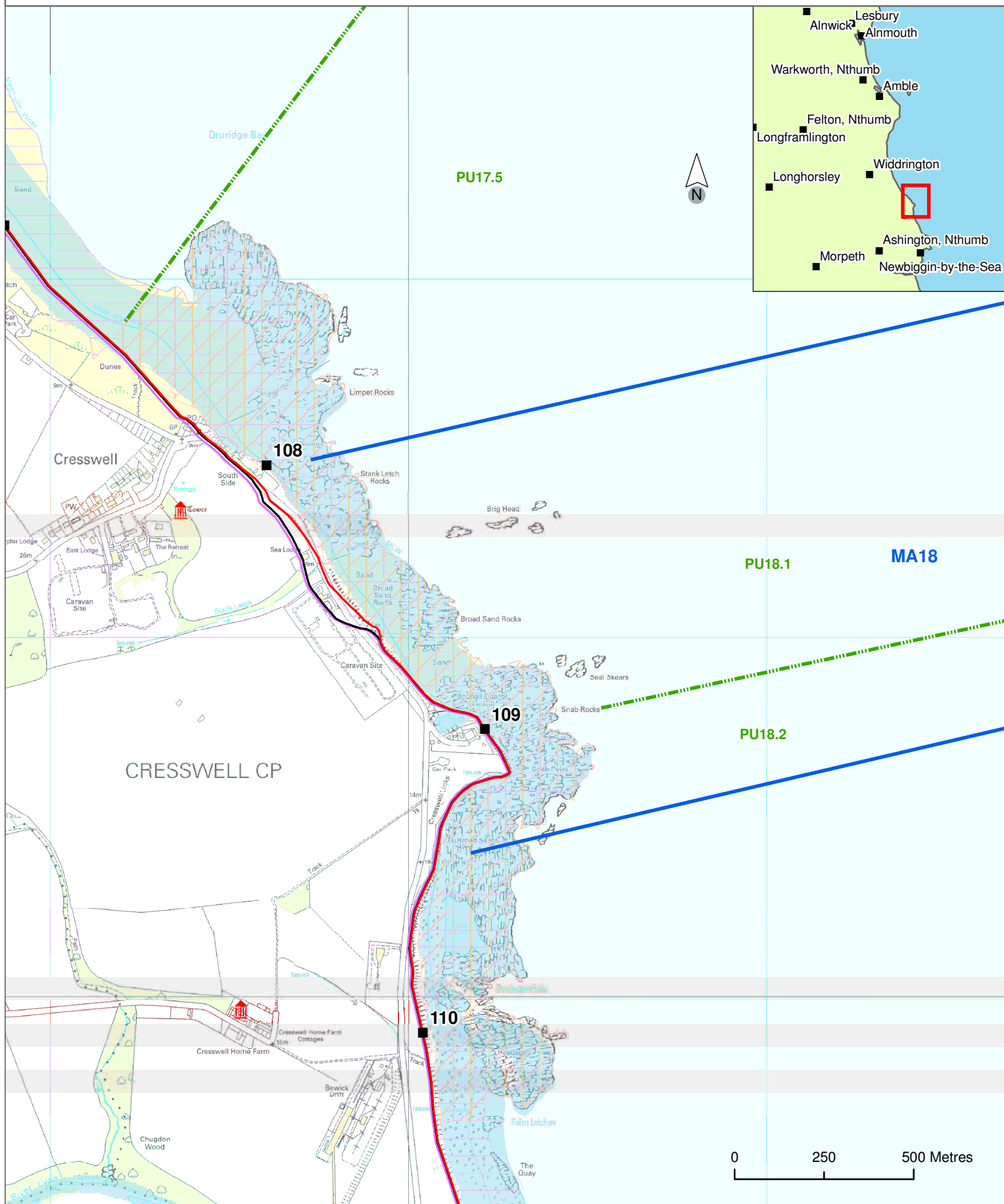
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units












**Policy Development Zone 4 - Seaton Point to Beacon Hill
Management Area 18 - Snab Point (Ch 108 to 109.5)**



Predicted Shoreline Position with No Active Intervention

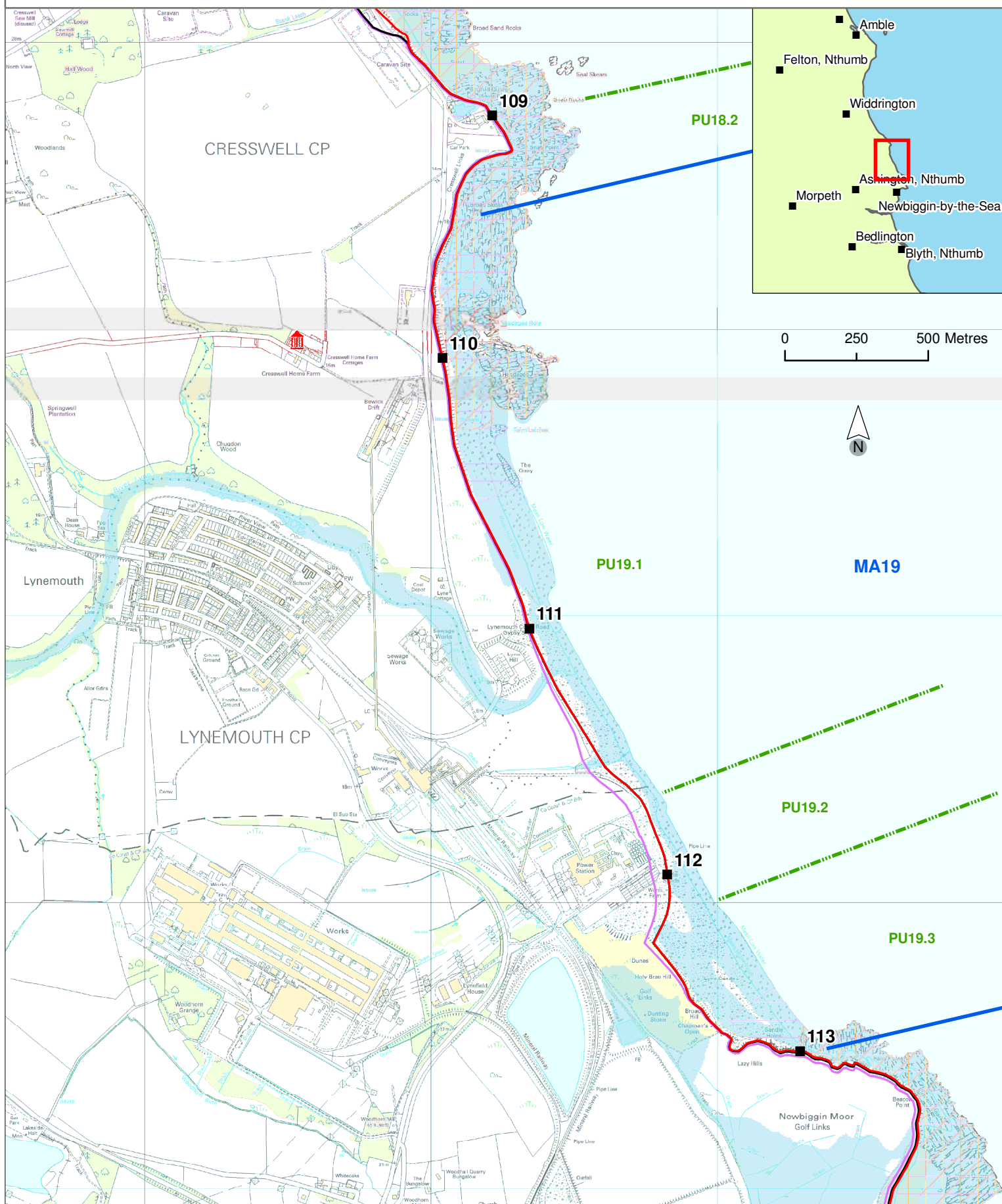
— 20 Years
— 50 Years
— 100 Years

-  SPA
-  RAMSAR
-  SAC
-  SSSI
-  NNR

-  Scheduled Ancient Monuments
-  EA Flood Zone - Sept 07
-  Management Areas
-  Policy Units



Policy Development Zone 4 - Seaton Point to Beacon Hill Management Area 19 - Lynemouth Bay (Ch 109.5 to 113)



Predicted Shoreline Position with No Active Intervention

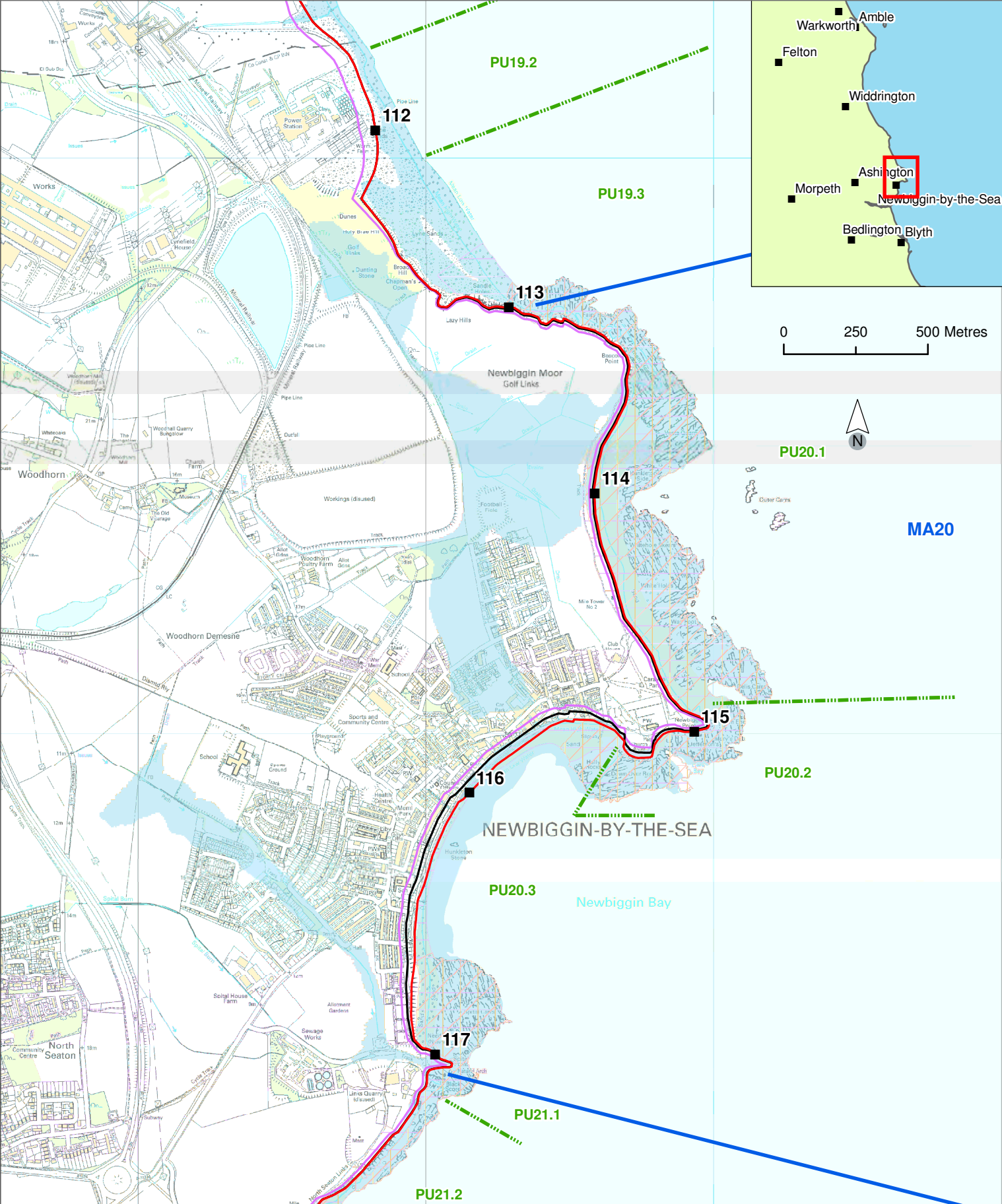
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 5 - Beadon Hill to Seaton Sluice Management Area 20 - Newbiggin (Ch 113 to 117)



Predicted Shoreline Position with No Active Intervention

- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 5 - Beadon Hill to Seaton Sluice Management Area 21 - Spital Point to Blyth East Pier (Ch 117 to 125)



Predicted Shoreline Position with No Active Intervention

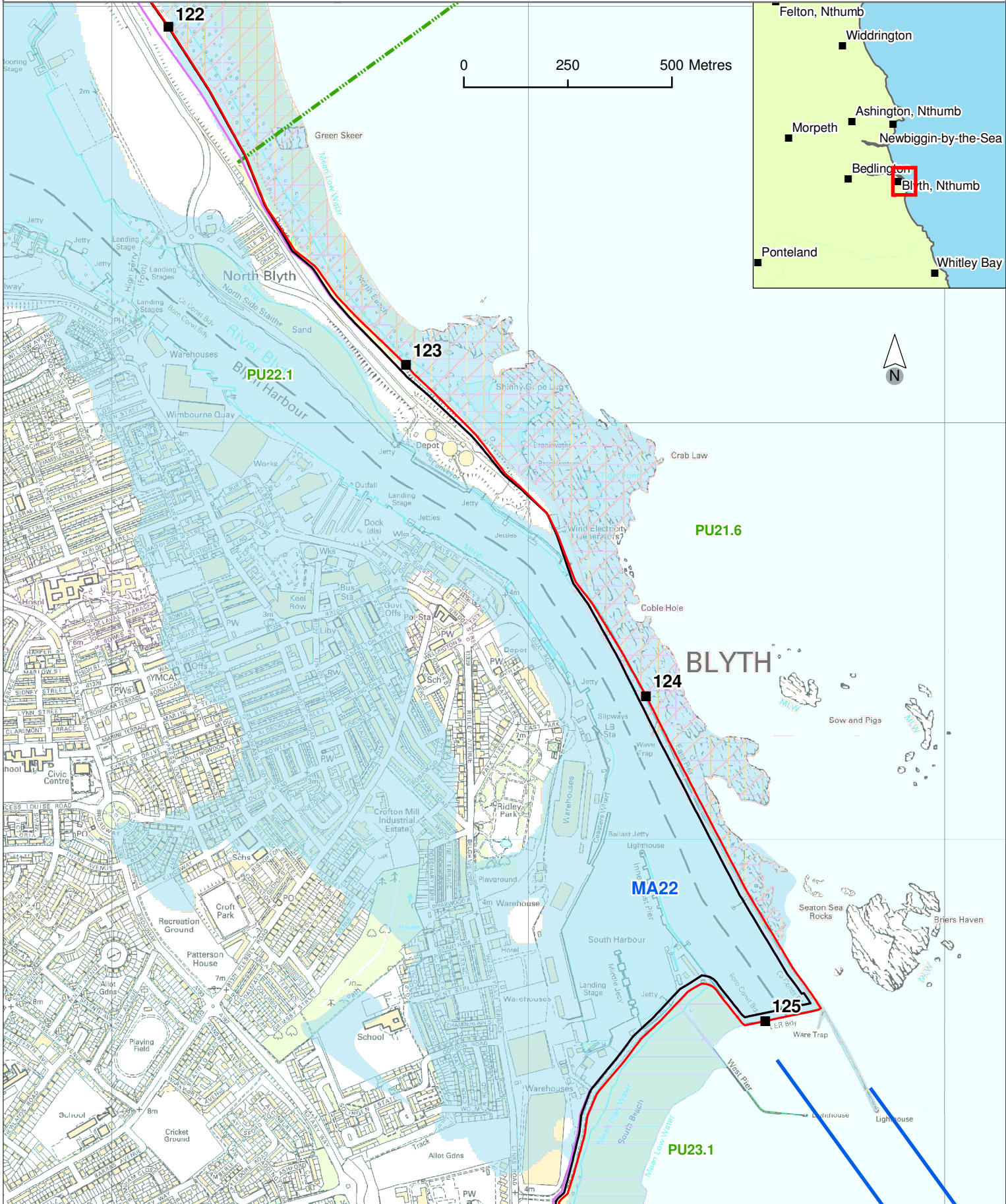
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 5 - Beadon Hill to Seaton Sluice
Management Area 22 - Blyth Harbour (Ch 125)



**Predicted Shoreline Position
with No Active Intervention**

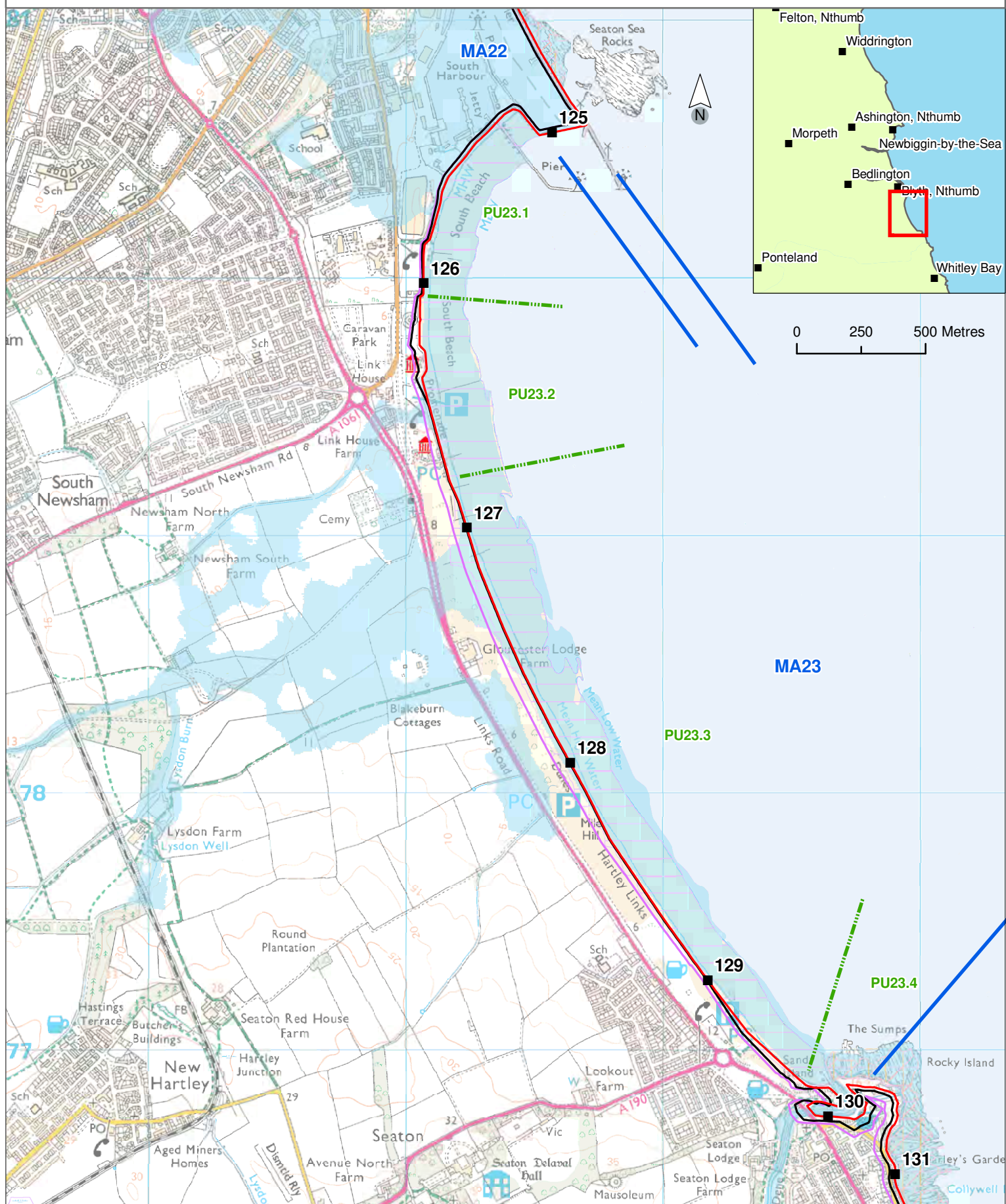
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units











Policy Development Zone 5 - Beadon Hill to Seaton Sluice
Management Area 23 - Blyth West Pier to Seaton Sluice (Ch 125 to 130)



Predicted Shoreline Position with No Active Intervention

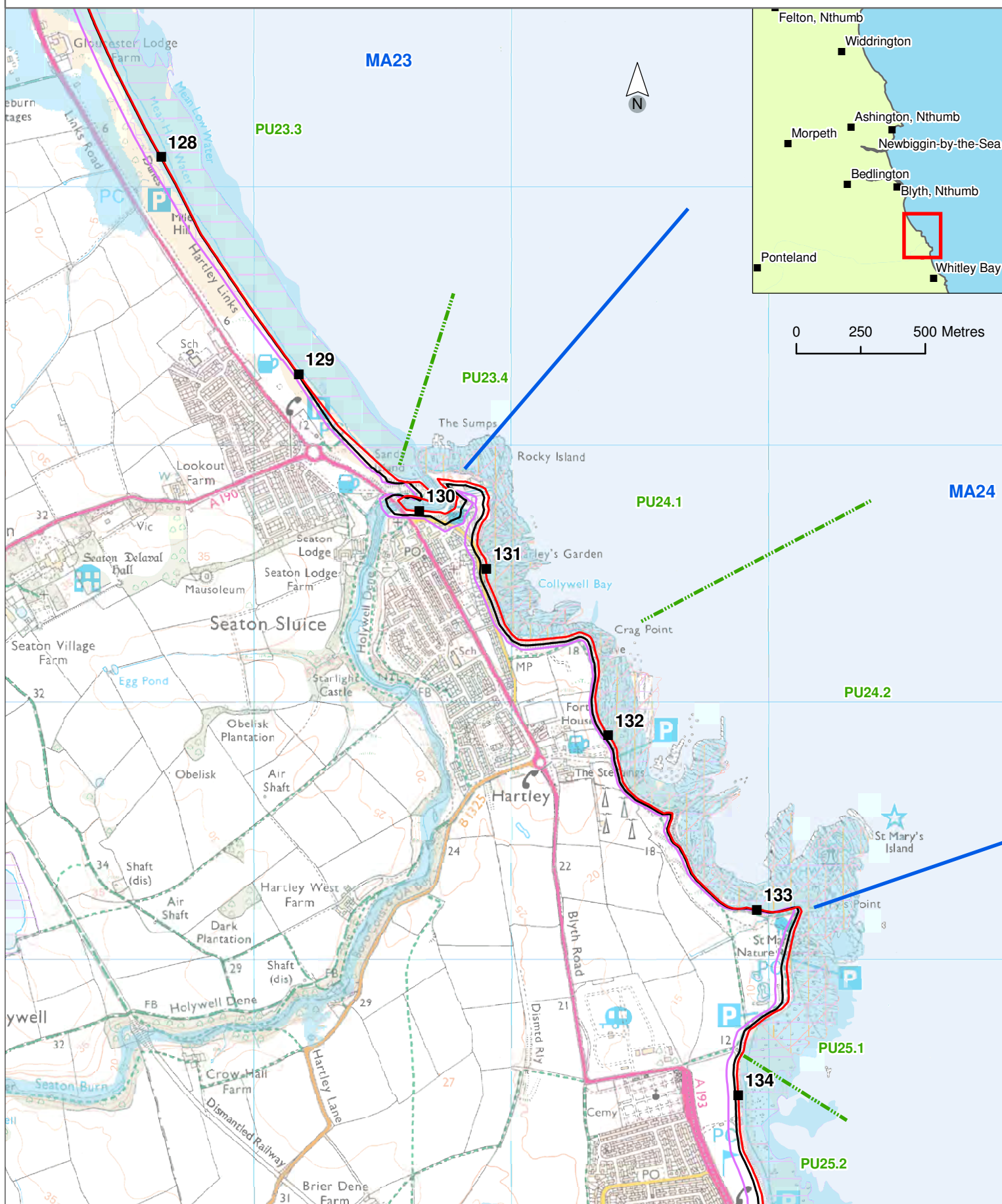
— 20 Years
— 50 Years
— 100 Years

-  SPA
-  RAMSAR
-  SAC
-  SSSI
-  NNR

-  Scheduled Ancient Monuments
-  EA Flood Zone - Sept 07
-  Management Areas
-  Policy Units



Policy Development Zone 6 - Seaton Sluice to River Tyne Management Area 24 - Seaton Sluice to Curry's Point (Ch 130 to 133)



Predicted Shoreline Position with No Active Intervention

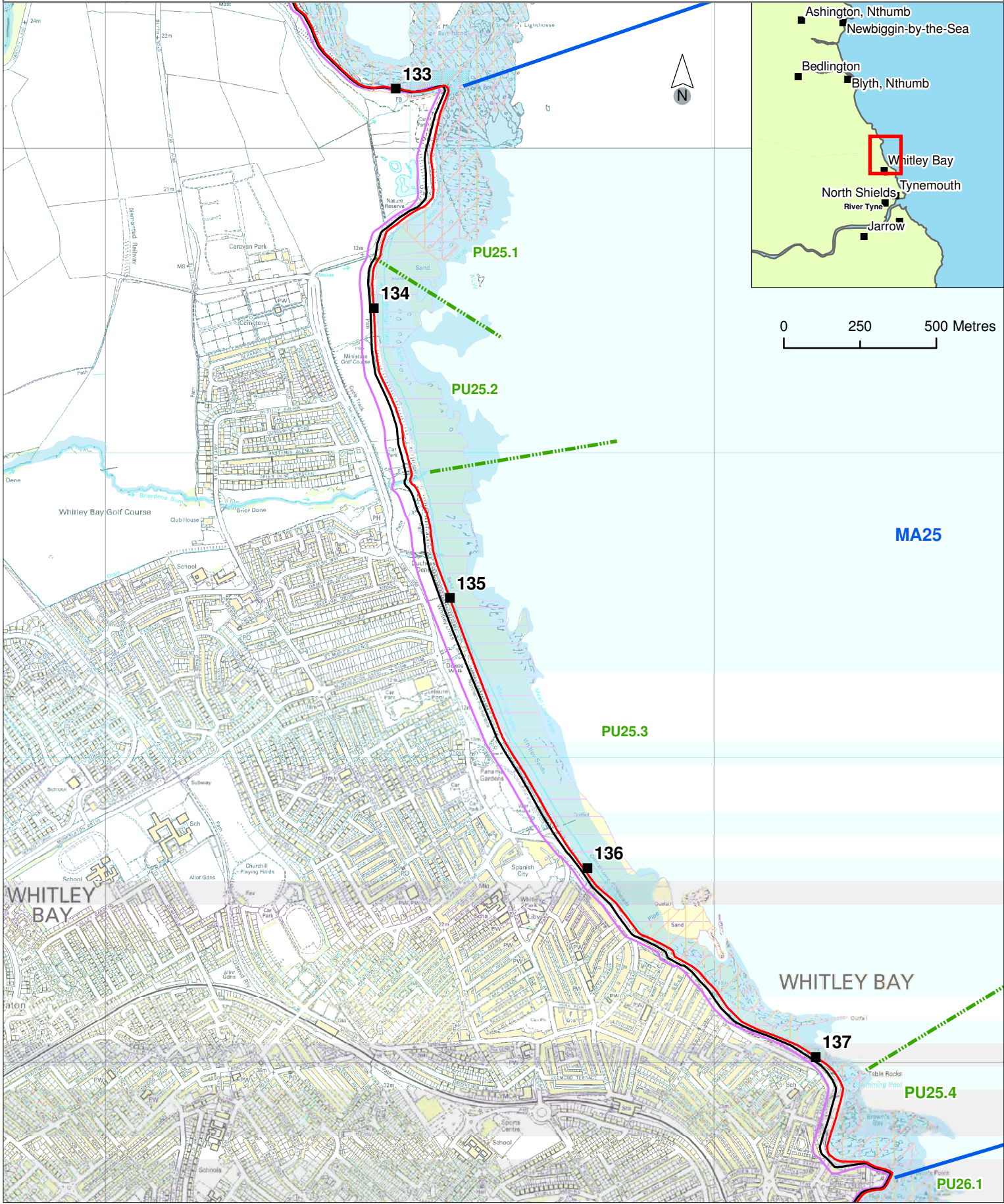
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



Policy Development Zone 6 - Seaton Sluice to River Tyne
Management Area 25 - Curry's Point to Brown's Point (Ch 133 to 137.5)



Predicted Shoreline Position
with No Active Intervention

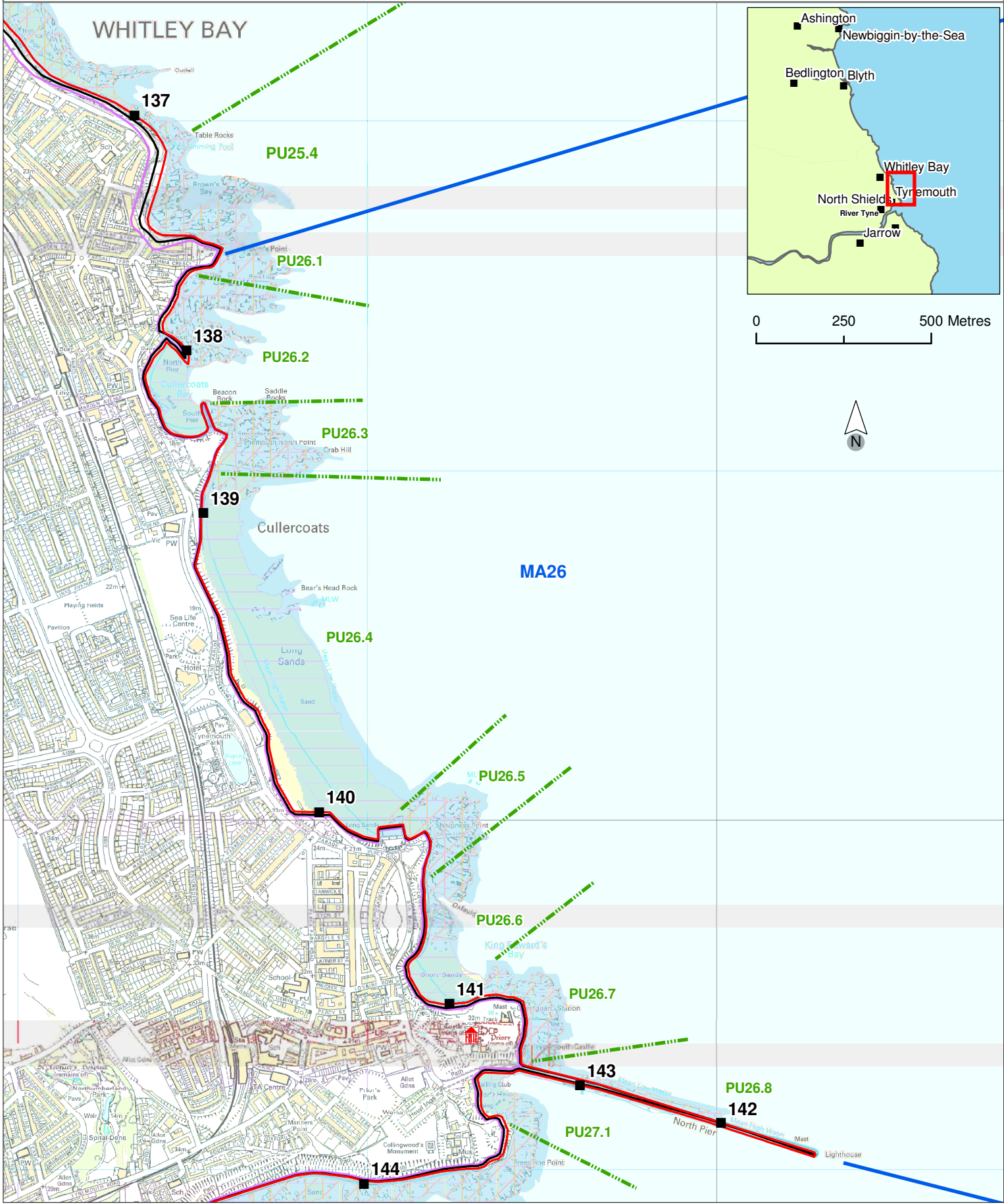
- 20 Years
- 50 Years
- 100 Years

- SPA
- RAMSAR
- SAC
- SSSI
- NNR

- Scheduled Ancient Monuments
- EA Flood Zone - Sept 07
- Management Areas
- Policy Units



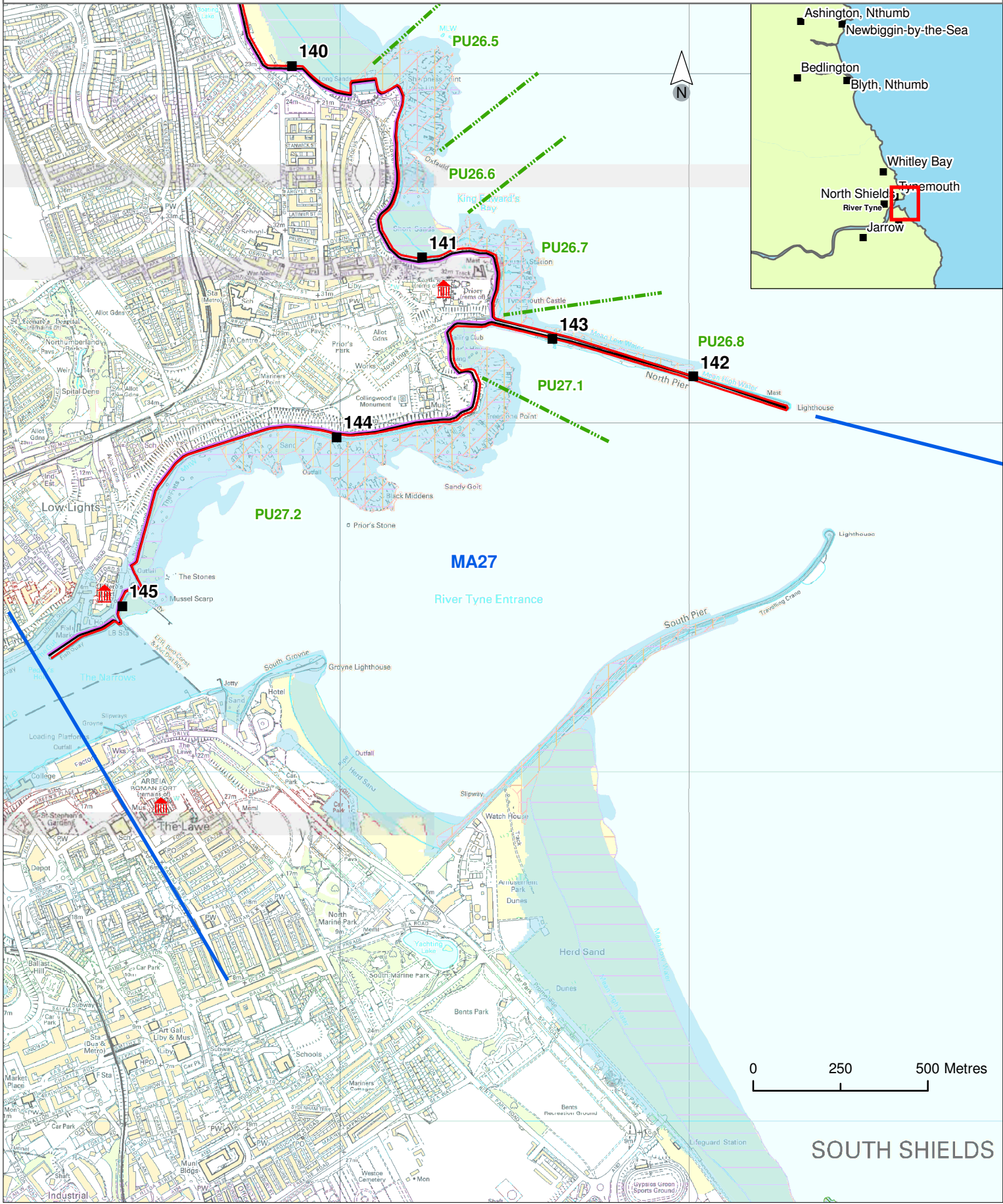
Policy Development Zone 6 - Seaton Sluice to River Tyne
Management Area 26 - Brown's Point to Tynemouth North Pier (Ch 137.5 to 143)



Predicted Shoreline Position with No Active Intervention	SPA	Scheduled Ancient Monuments
20 Years	RAMSAR	EA Flood Zone - Sept 07
50 Years	SAC	Management Areas
100 Years	SSSI	Policy Units
	NNR	



Policy Development Zone 6 - Seaton Sluice to River Tyne
Management Area 27 - Tynemouth North Pier to Fish Quay (Ch 143 to 145.3)



Predicted Shoreline Position with No Active Intervention	SPA	Scheduled Ancient Monuments
20 Years	RAMSAR	EA Flood Zone - Sept 07
50 Years	SAC	Management Areas
100 Years	SSSI	Policy Units
	NNR	



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