

Cell 1 Regional Coastal Monitoring. Mapping of BAP Habitats from Aerial Imagery.

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GIS-based Priority BAP Habitat mapping

A GIS-based BAP habitat mapping exercise was undertaken in 2015 using aerial photography collected in 2012/13 covering the coastal strip between Flamborough Head and Berwick upon Tweed. Mapping used the 'Habitat Capture' GIS tool to classify Ordnance Survey MasterMap polygons by priority BAP habitats following the specification for habitat mapping of the national network of strategic regional coastal monitoring programmes of England. The habitats to be classified are defined in Appendix 1. All habitat types have been classified according to the Integrated Habitat System (IHS) classification codes. IHS enables recording to whatever level of detail is required. Due to the hierarchical set up of the definitions, analysis of the data can take place at many different levels, making the data useful for a wide variety of purposes. This enables large scale mapping and monitoring to be undertaken at regional and national scales.

There are some limitations of relying solely on aerial photography for habitat mapping. Habitat classification based on this method relies on tone and pattern of the image and interpretation can be variable and often difficult, depending on the habitat type. Difficulty in the interpretation varies between each habitat category but generally man-made habitats, such as arable farmland, improved grassland, urban and conifer plantations or other homogenous habitats including bracken, standing open water, rivers and streams are easier to recognise. These are the dominant habitat types and cover the largest areas across the coastline.

Other semi-natural habitat types also frequently fall under priority habitat categories. The tone and colour of these habitats can be more variable and it is rare for a single priority habitat to form at site level, and instead a single polygon will be made up of a mosaic of different habitat types. The specification for mapping does not account for mosaic habitats and recommends classification by the dominant habitat type in the defined area. Due to the scale of the mapping some habitat types are not included as they generally only occur at site level, such as some fen, marsh and swamp habitats, particularly marginal and inundation vegetation, exposed rock and linear features such as hedgerows and lines of trees. This is likely to lead to over representation of woodland, scrub and grassland habitat types.

Field survey

Following aerial photograph interpretation, a programme of field reconnaissance was undertaken to ground truth the GIS data. Field validation was carried out during the optimal survey period for habitat surveys, in September 2015. The aim was to ground truth the habitat classifications against the observations in the aerial photos. The field surveys focused on semi-natural (priority habitat types). A total of 12 sites were identified across the coastline, which gave a good representation of priority habitats across each region of coastline. The locations of sites visited are provided in Appendix 2. The results of the site surveys are documented in Table 1.

Table 1. Results of ground truthing

Site / Grid Ref	GIS-based habitat	Field-based classification
St Abbs Head – Scottish Borders NT 9014 6892	HE0	No HE0 recorded on site. Most plots GI0. Two plots were GN3 – Abundant false oat grass, frequent Yorkshire fog and common bent, locally abundant creeping thistle, nettle and white clover and GM1 – locally dominant thrift, red fescue and occasional yarrow, lady's bedstraw and harebell.
	WB2	Most plots correctly identified. One plot WB3Z – Dominated by Sycamore with occasional hawthorn and a dominant ground layer of honeysuckle.
	WB3Z	Three plots out of five misidentified. One plot –conifer plantation (WCZ) and the others were Gorse Scrub (WB2).
	CRO	All plots correctly identified.
	GI0	Plots correctly identified, apart from the misidentified plots for HE0.
	SR1	Some plots misidentified as they are not coastal facing. These were reclassified as GM1Z – Abundant red fescue, locally abundant wood sage, occasional birdsfoot trefoil, ribwort plantain, lady's bedstraw, harebell and thrift. Plus local patches of bell heather.
	LSZ	All plots correctly identified.
St Abbs Head– Scottish Borders NT 9148 6810	HE0	No HE0 recorded on site. Most plots GI0. One plot GN3 – Abundant Yorkshire fog, locally abundant tufted hair grass, frequent creeping thistle, yarrow, occasional hogweed, hairy sedge, common sorrel plus curled dock, white clover, harebell, tormentil, creeping buttercup, sweet vernal and timothy One plot GA1 – Frequent sweet vernal, occasional matt grass, bell heather and harebell plus field scabious, tormentil and red fescue; and one plot EM11 0 common reed bed
	WB2	All plots correctly identified.
	SR1	All plots correctly identified.
	LRZ	All plots correctly identified.
Goswick – Northumberland NU 0602 4524	HE0	One plot only. Misidentified, should be GI0
	GNZ	All plots misidentified should be GI0
	GN4	All plots correctly identified.
	GPO	Not sure what this refers too. Should be SS1
	CRO	All plots correctly identified.
	SS1	Some plots more definable at a local scale SS13 – dominated by marram, abundant red fescue and occasional, lady's bedstraw, harebell and yarrow Some habitat types missed. GMZ – abundant lady's bedstraw, frequent birdsfoot trefoil and locally abundant harebell, yarrow and restharrow. EM214 – Sea club rush GM1 – dominant red fescue, locally dominant saltmarsh rush and eyebright plus occasional birdsfoot trefoil, sea plantain and bottle sedge.

Dunstanburgh Castle – Northumberland NU 2571 2178	GA1	One plot only. Misidentified, should be GN31 – dominated by false oat grass
	SR1	Some habitat types missed. EM422 – soft rush, hard rush and jointed rush, creeping bent, wavy bittercress, purple moor grass and creeping bent EM18 – Bulrush and standing water EM183 – Bur-reed and bulrush BRZ – continuous bracken WB2 – gorse scrub
	AS0	One plot only. Misidentified, should be GN32 – Dominated by tufted hair grass, frequent Yorkshire fog plus soft rush.
	LRZ	All plots correctly identified.
	CRO	All plots correctly identified.
Lynemouth – Northumberland NZ 2998 9039	CRO	Mostly correct apart from GI0 extends further into one field than was marked on the plan.
	GN4	One plot only – Misidentified, should be GI0
	WB2	All plots misidentified, should be WB1 or WB3Z – recently planted mixed woodland with ash, hawthorn, silver birch, willow, alder and conifers.
	EM31	Two plots only. Misidentified, should be EM212 – branched bur reed, common reed, broad leaved dock and hedge bindweed on a concrete base.
	AR0	All plots correctly identified.
	HE0	No HE0 recorded on site. Most plots SS1. No access to the inland plot.
	SS1	All plots correctly identified.
	LSZ	All plots correctly identified.
Druridge Bay – Northumberland NZ 2734 9649	EM4	Mainly a sub-category of EM4 but overall a mosaic habitat of: EM422 – rush pasture with false fox sedge and EM183 – <i>Typha spp.</i> swamp.
	AS0	All plots correctly identified.
	WB2	Two plots only. Misidentified, should be: - WB34 – willow and alder
	SS1	All plots correctly identified.
	LSZ	All plots correctly identified.
Blackhill – Durham NZ 4418 4273	WB36	Misidentified, should be a mosaic of BRZ and WB3Z
	WB3Z	All plots correctly identified. Magnesian limestone woodland
	GC1	Not typical GC1 but does have some calcareous influences. Excellent example of a specie rich grassland, should be: - GNZ – small scabious, eyebright, yellow wort, yellow rattle, bird foot trefoil, selfheal, black knapweed, meadow sweet, common fleabane, common sedge, field horsetail and orchids; and WB2 – gorse scrub
	SR1	Some habitat types missed. BRZ – Continuous bracken WB2 – Gorse scrub

		EM11 – common reed
	LSZ	All plots correctly identified.
	Missing polygon	Additional habitat types missed include: - GN3 – Frequent false oat grass and cocksfoot, abundant ribwort plantain and occasional black knapweed, common hogweed, yarrow, yellow rattle, greater bird foot trefoil and lady's bedstraw.
Seaton Snook – Durham NZ 5308 2809	GN4	Mostly correct apart from GI0 extends further into two fields than was marked on the plan.
	GI0	All plots correctly identified.
	SS1	All plots correctly identified.
	LSZ	All plots correctly identified.
	AR5	All plots correctly identified.
Skinningrove –Redcar and Cleveland NZ 7132 1998	WB2	Mostly correct. Additional habitat types missed include: - WB22 – Hawthorn scrub
	WB3Z	All plots correctly identified.
	GN1	Mostly correct. Additional habitat types missed include: - GM14 – dominated by red fescue, with occasional yellow wort, wild carrot, tall mellilot, common centuary, pyramidal orchid and birds foot trefoil. GI0 extends further into one field than was marked on the plan.
	GI0	All plots correctly identified.
	CR0	All plots correctly identified.
	SR1	All plots correctly identified.
	LSZ	All plots correctly identified.
Ruswarp – North Yorkshire NZ 8926 0966	WB2	All plots misidentified, should be: - WB3Z – occasional oak and ash, frequent holly, sycamore plus beech. Ground flora of dog's mercury and soft shield fern. GN3 – Frequent false oat grass and cocksfoot with abundant nettle, creeping thistle and broad leaved dock EM1 – dominated by reed canary grass with occasional bullrush
	WB3Z	Mostly correct. Additional habitat types missed include: - WCZ – conifer plantation
	GN4	No access to plot but appears to be GI0
	AR0	All plots correctly identified.
	CR0	All plots correctly identified.
Ravenscar – North Yorkshire NZ 9743 0183	HE0	Some plots more definable at a local scale and additional habitat types missed include: - HE11 – dominated by heather with occasional bell heather and gorse with sheeps fescue, common bent, matt grass, sweet vernal and bilberry. BRZ – Continuous bracken WCZ – Conifer plantation
	WB2	Mostly incorrect. Additional habitat types missed include: -

		WB3Z – frequent oak and wych elm, frequent rowan and silver birch. Ground flora of male fern, bilberry, scaly male fern and locally dominant greater woodrush. BRZ – Continuous bracken
	SR1	All plots correctly identified.
	LRZ	All plots correctly identified.
Speeton – North Yorkshire TA 1508 7534	WB3Z	All plots correctly identified.
	GI0	Mostly correct. Additional habitat types missed include: - CRO
	GA1	All plots misidentified, should be: - GN3 – Frequent false oat grass and cocksfoot with abundant creeping thistle
	GNZ	All plots misidentified, should be: - GI0
	CRO	All plots correctly identified.
	SR1	All plots correctly identified.
	LSZ	All plots correctly identified.

Conclusions

Interpretation of habitat from aerial survey data will inevitably be limited by the scale of the study, the quality of data and visible habitat features. However, the data do offer a method for rapid classification of large areas of land with a high degree of accuracy for most habitat types.

Based on the ground-truthing exercise undertaken for Cell 1, the following limitations of aerial photo-based mapping were identified. Any necessary corrections to the GIS dataset are highlighted:

- Large areas of Improved Grassland had been classified as Dwarf Shrub Heath (HE0). These were predominantly around St Abbs Head, with occasional plots further south. These two broad habitat categories are easily disenable and it seems likely this relates to user error in the original classifications. These errors have all been corrected in the GIS.
- Misclassifications in certain woodland categories were occasionally observed. Generally there was an overestimation of scrub woodland and a misrepresentation of broadleaved woodlands. It is difficult to distinguish between some woodland categories using aerial photography alone because the woodland type is influenced by ground flora that is often obscured by trees. Some woodland types that form linear features rather than wide plots, such as wet woodlands, are also generally understated. These errors were amended following the field validation exercise.
- At St Abbs Head some slopes were incorrectly labelled as being coastal-facing despite facing inland. This issue relates to the complex form of some parts of the coast where streams flow through sinuous incised valleys that are unclear in aerial imagery. These polygons were re-classified as maritime grassland. In future work, LiDAR data could be used to determine the aspect of slopes.
- Some IHS habitat types were missed due to the small mapping scale and methodology that requires a single habitat classification for polygons that comprise a variety of habitat types. In some cases large polygons with a variety of habitat types were reclassified based on site observations.

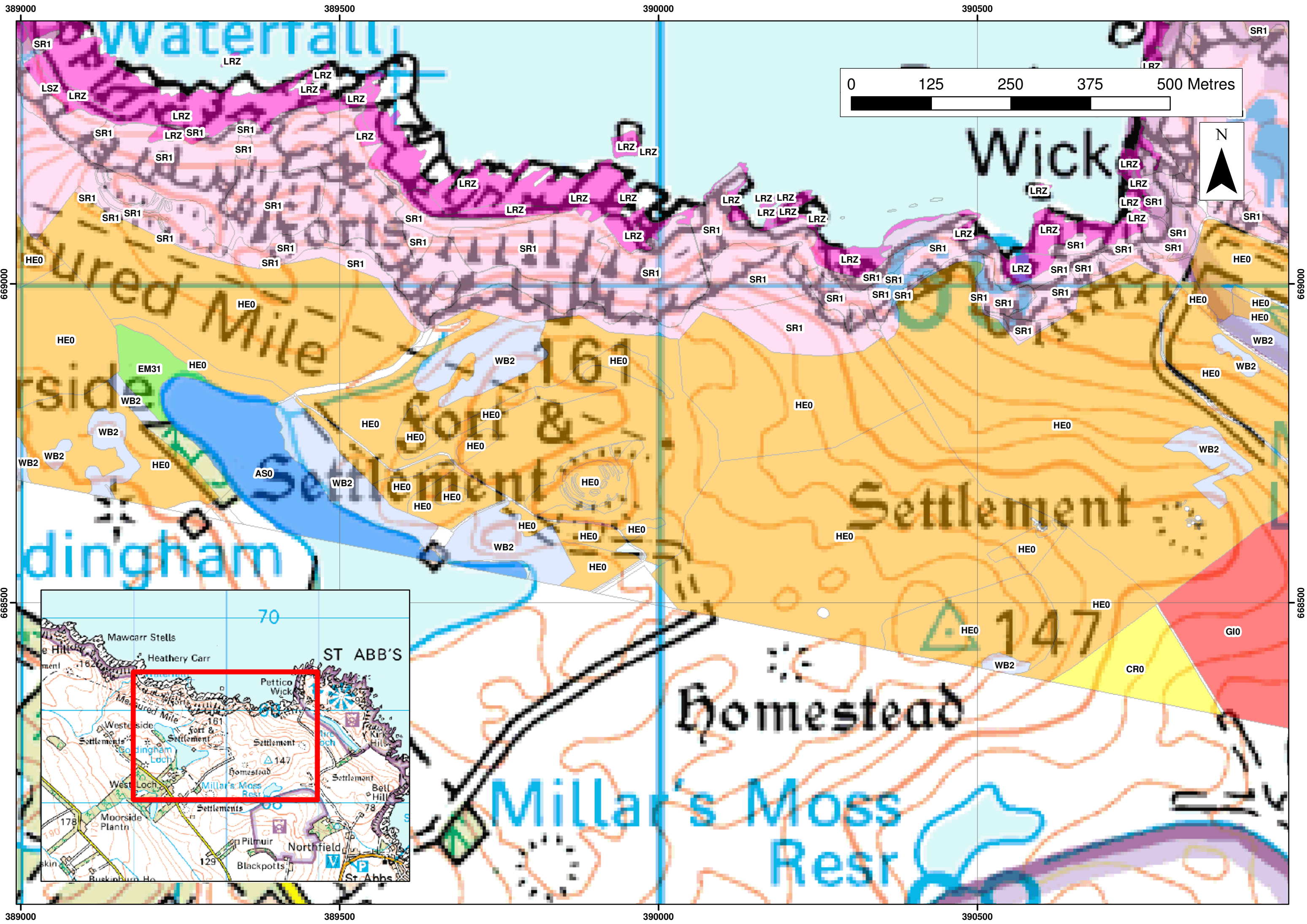
In summary, the main limitation was the regional mapping scale, which doesn't account for habitats which occur at a local scale or mosaic habitats. This inevitably means an overrepresentation of some habitat types. Especially for semi-natural habitat types which often have more variation in tone and pattern across the seasons and subsequently interpretation can be more variable.

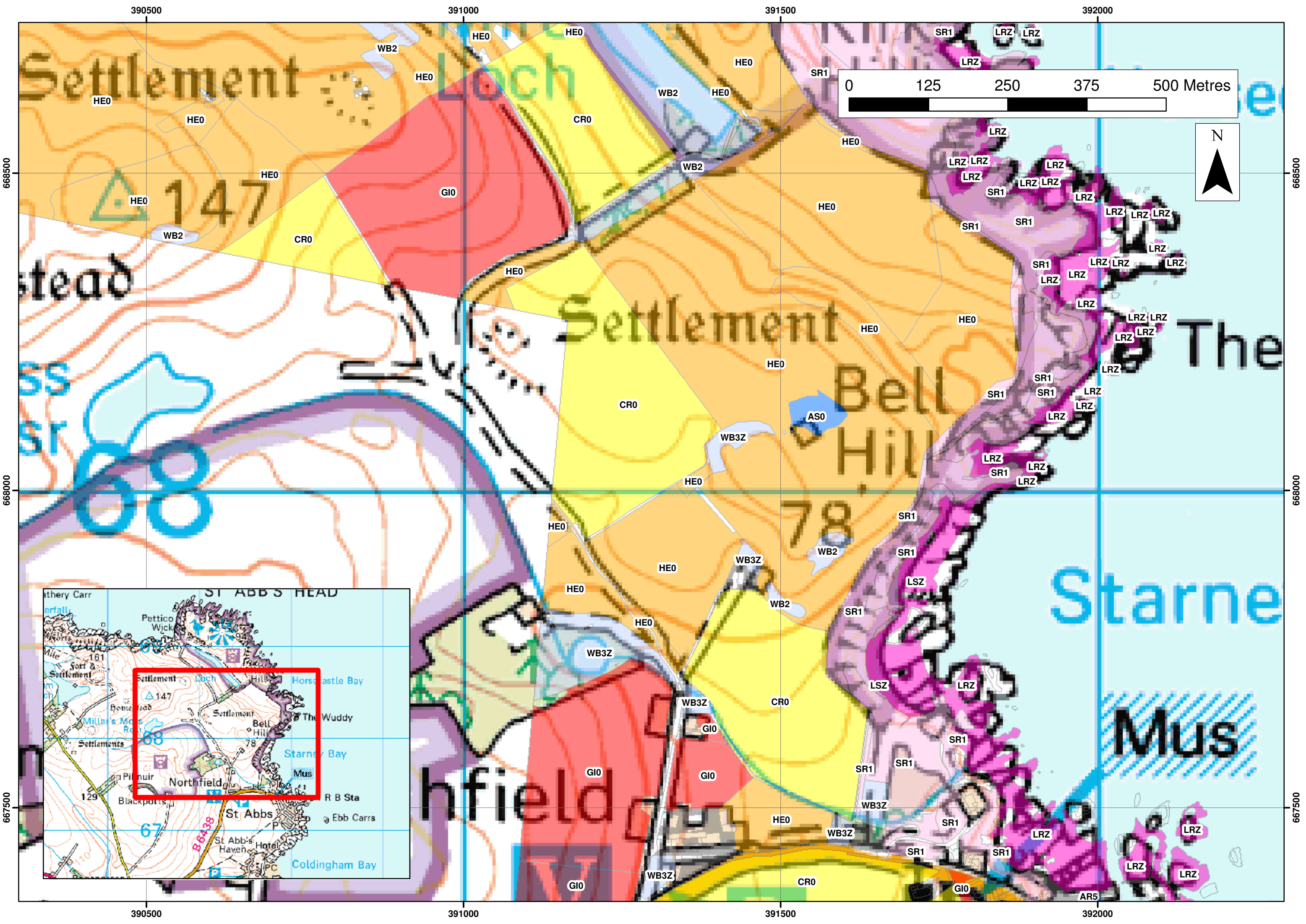
Appendix 1 –Habitats to be mapped

Broad Priority habitat	Priority habitat and IHS code
Broadleaved, Mixed and Yew Woodland	WB3 Broadleaved woodland
	WB31 Upland oakland
	WB32 Upland mixed ashwoods
	WB331 Lowland Beech and yew woodlands
	WB34 Wet woodland
	WB35 Upland birch woodland
	WB36 Lowland mixed deciduous woodland
	WB3Z Broadleaved woodland
	FT1 Traditional Orchard
Coniferous Woodland	WC1 Native pine woodlands
Acid Grassland	GA1 Lowlands dry acid grassland
Calcareous Grassland	GC1 Lowland calcareous grassland
	GC2 Upland calcareous grassland
Neutral Grassland	GN1 Lowland meadows
	GN2 Upland hay meadows
	GN4 Grazing marsh pasture
	GNZ Other neutral grassland
Bogs	EO1 Blanket bog [Blanket bogs]
	EO2 Lowland raised bog
Fen, Marsh and Swamp	EM11 Reedbeds
	EM31 Fens [lowland]
	EM32 Fens [upland]
	EM4 Purple moor grass and rush pastures
Standing Open Waters and Canals	AS11 Natural dystrophic lakes and ponds
	AS21 Oligotrophic lakes
	AS31 Mesotrophic lakes
	AS4 Eutrophic standing waters
	AS7 Aquifer fed naturally fluctuating water bodies
	AP1 Pond
Rivers and Streams	AR0 Rivers and streams
Arable and Horticulture	CR61 Arable field margins
Boundary and Linear Features	LF11 Hedgerows
Supralittoral Rock	SR1 Maritime cliff and slopes
Supralittoral Sediment	SS1 Coastal sand dunes
	SS2 Machair
	SS31 Coastal vegetated shingle

Broad Priority habitat	Priority habitat and IHS code
	SS3Z Unvegetated shingle above the high tide mark
Littoral Rock	LR1 Intertidal chalk
	LR3 Sabellaria alveolata reefs
	LR4 Intertidal underboulder communities
	LRZ Other littoral rock
Littoral Sediment	LS2 Seagrass beds - Zostera noltii adjacent to saltmarsh
	LS3 Coastal saltmarsh
	LS4 Intertidal mudflats
	LS5 Sheltered muddy gravels
	LS6 Intertidal shingle
	LSZ Other littoral sediment
Sublittoral Sediment	LS7 Blue Mussel Beds on sediment
	IR7 Horse mussel beds
	IS2 Subtidal sands and gravels [inshore]
	IS3 Seagrass beds - Zostera marina & Z. angustifolia located on mid to lower foreshore and sub littoral zone
	IS4 Maerl beds
	Saline lagoons are made up of the following: IS5 Saline Lagoons with restricted sea connection AS61 Saline Lagoons with no sea connection
	IS6 Serpulid reefs
Sublittoral Rock	CS1 Cold-water coral reefs (Lophelia pertusa reefs)
	IR2 Sabellaria spinulosa reefs
	IR5 Tide-swept channels
	IR6 Subtidal chalk
Inland rock	PI1 Calaminarian grasslands of the Violetalia Calaminariae
Built-up areas and gardens	UR0 Built-up areas and gardens
Scrub	SC0 Scrub
Arable	CR0 Arable and horticulture
Improved grassland	GI0 Improved grassland
Dwarf Shrub Heath	HE0 Dwarf shrub heath
Habitat complex	Habitat complex code
Coastal and floodplain grazing marsh	CF1 Coastal and floodplain grazing marsh
Maritime cliff and slopes	MC1 Maritime cliff and slopes
Lowland Heathland	HL1 Lowland Heathland
Upland Heathland	HU1 Upland Heathland
Tidal	TD1 Tidal

Appendix 2. Ground truthing sites





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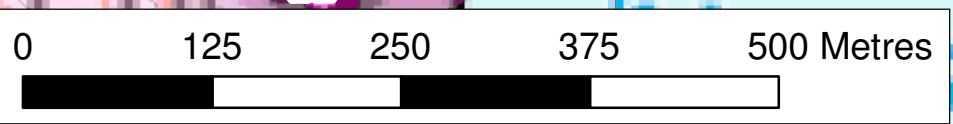
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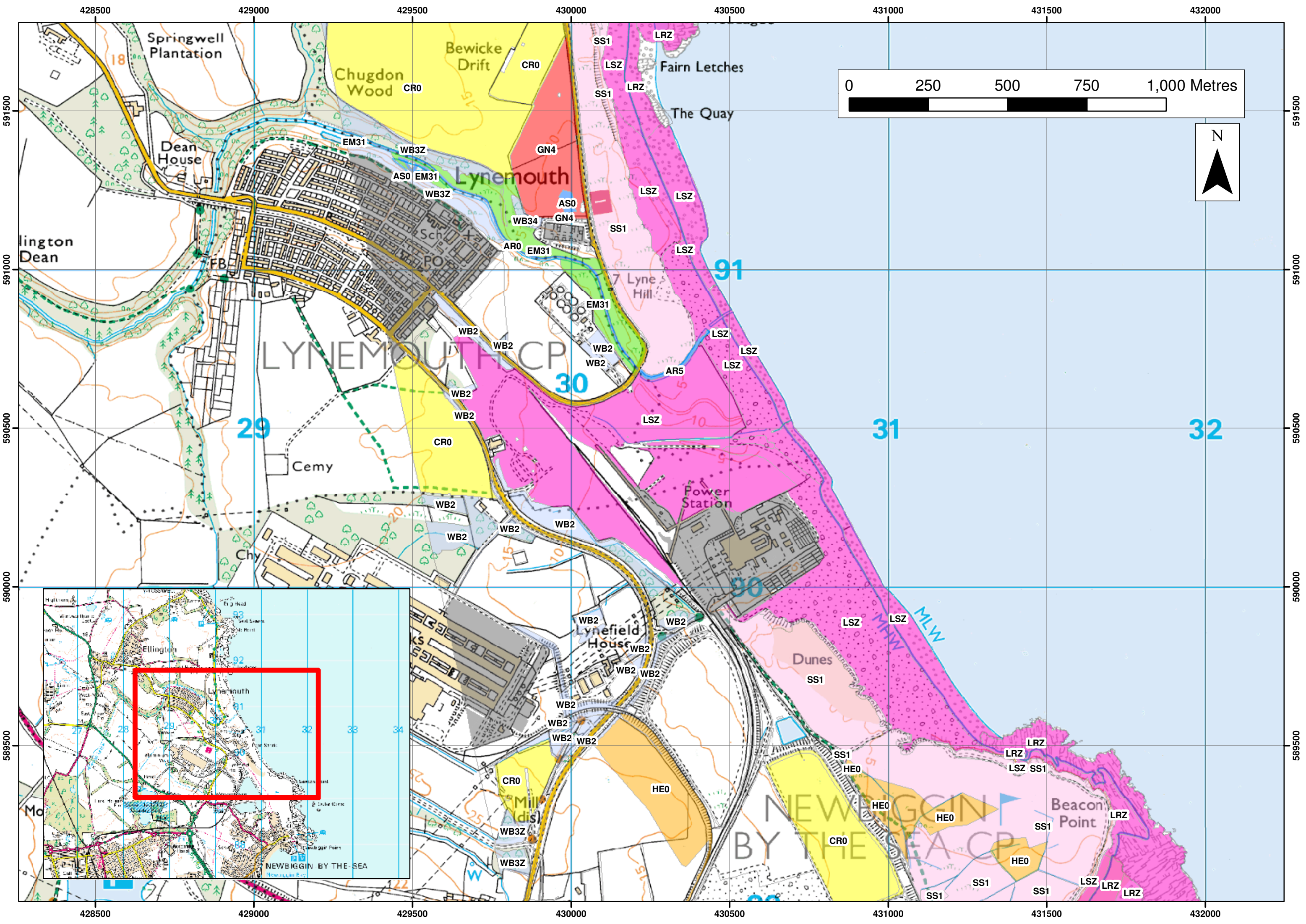
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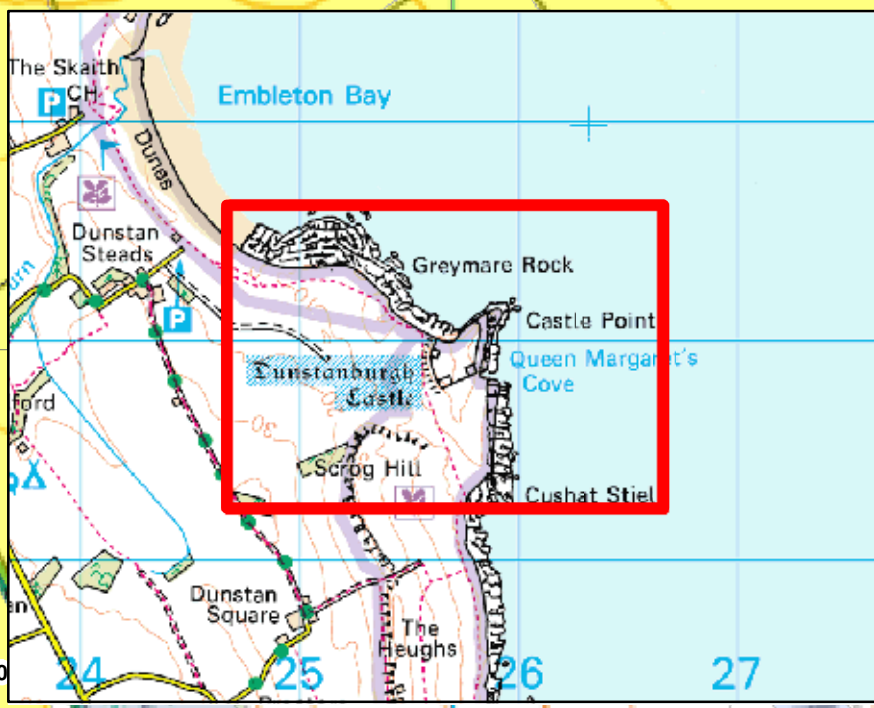
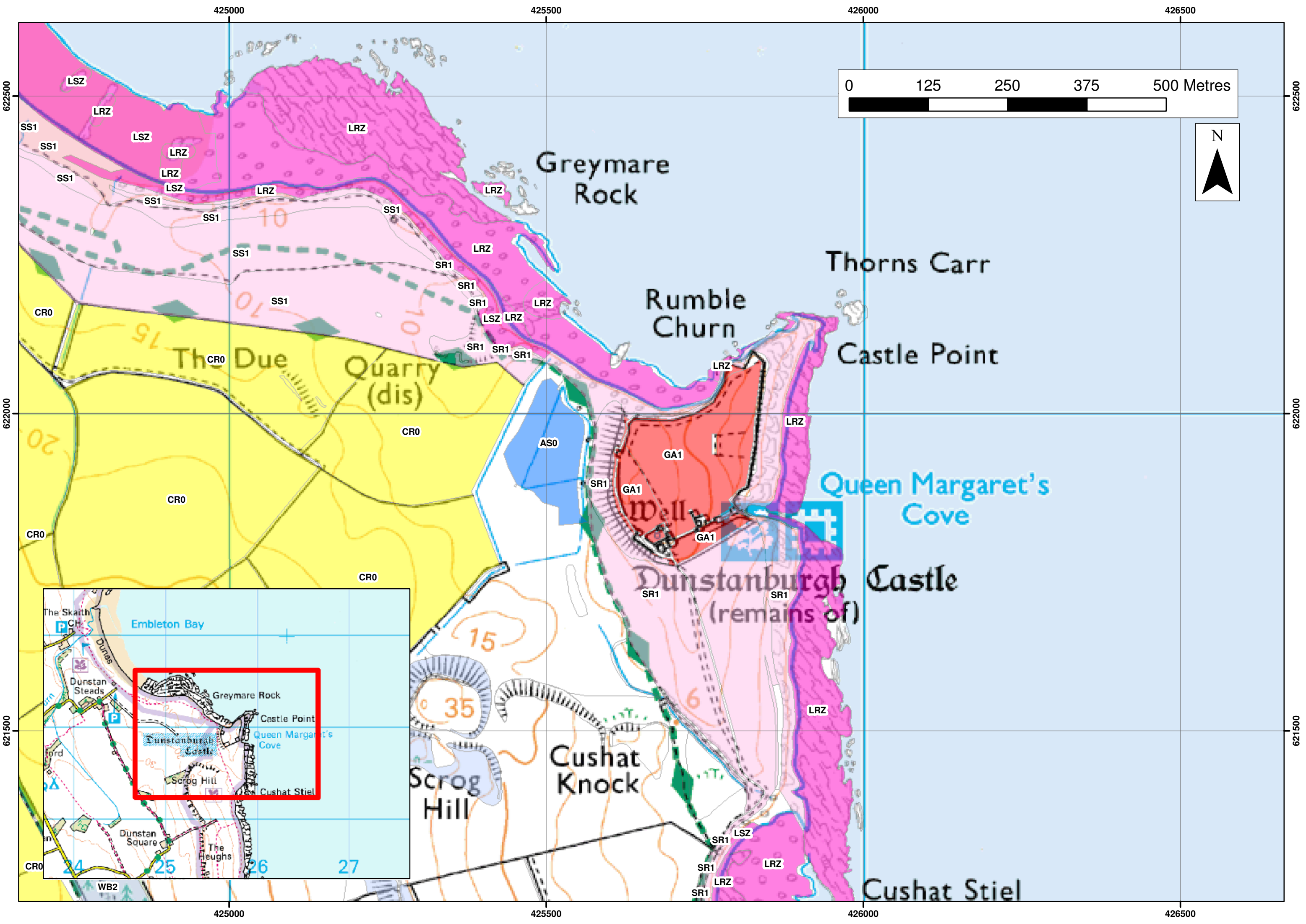
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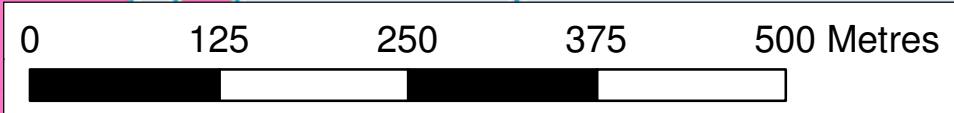
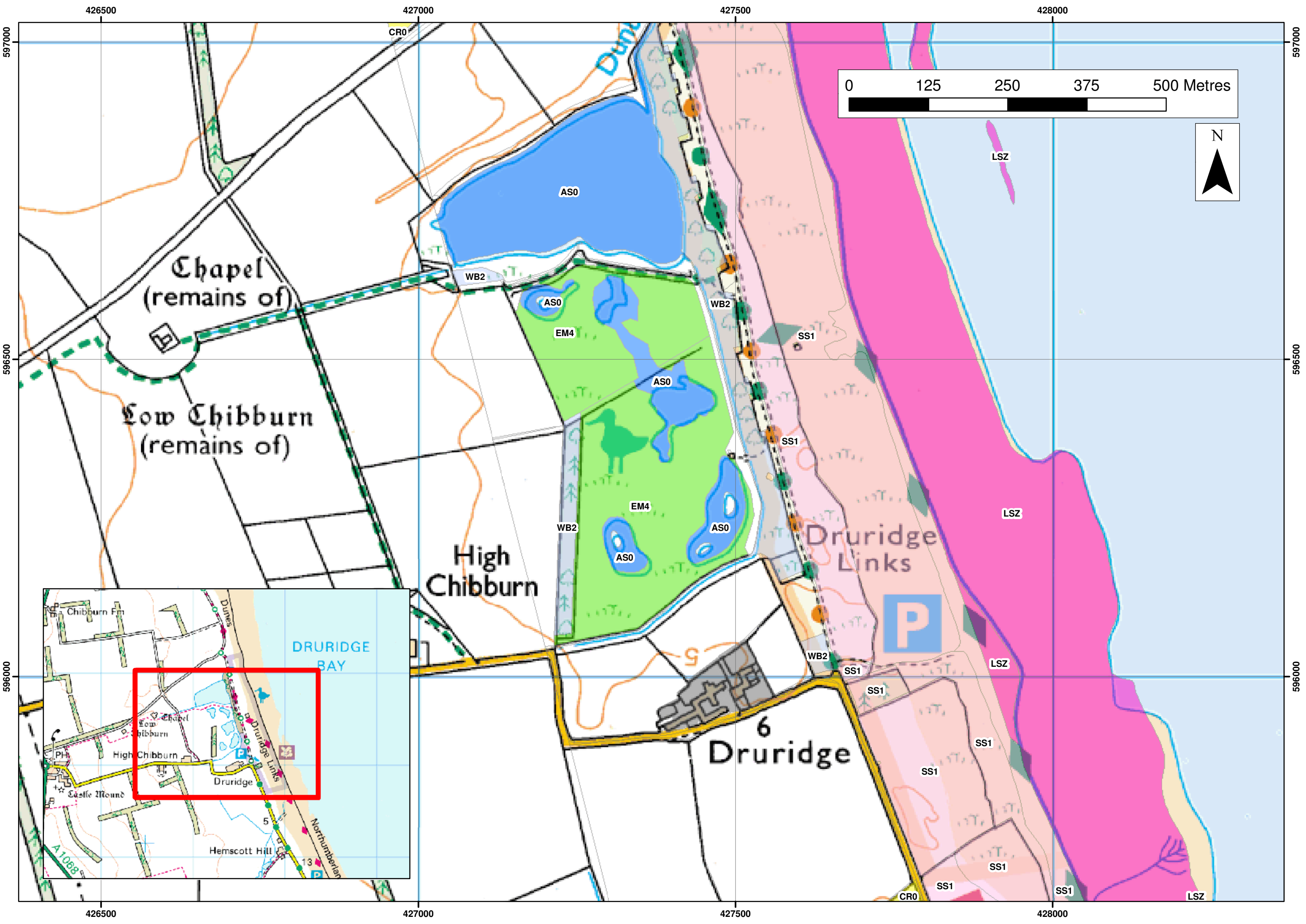
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Springwell Plantation
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Chugdon Wood
Fairn Letches
The Quay
Lynemouth
Lyne Hill
Power Station
Dunes
Beacon Point
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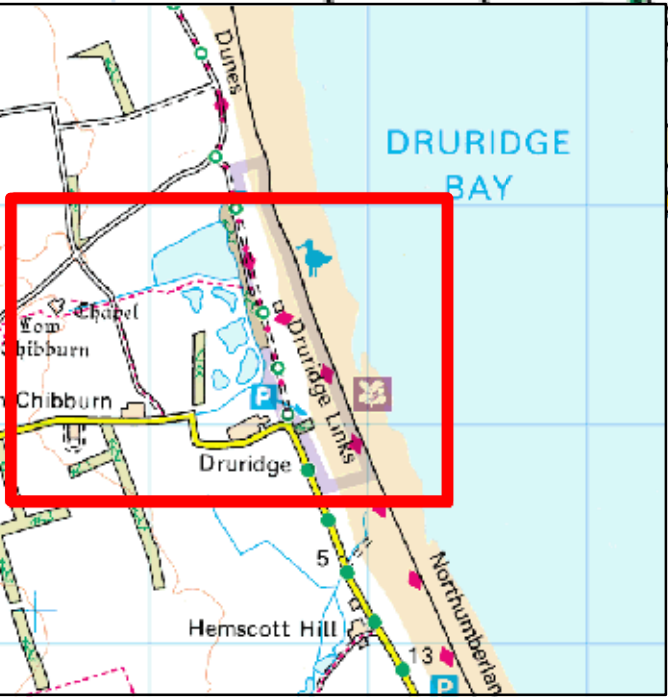
Chapel
(remains of)

Low Chibburn
(remains of)

High
Chibburn

Druridge
Links

6
Druridge



AS0

AS0

EM4

AS0

EM4

AS0

WB2

WB2

SS1

SS1

WB2

SS1

SS1

SS1

SS1

SS1

SS1

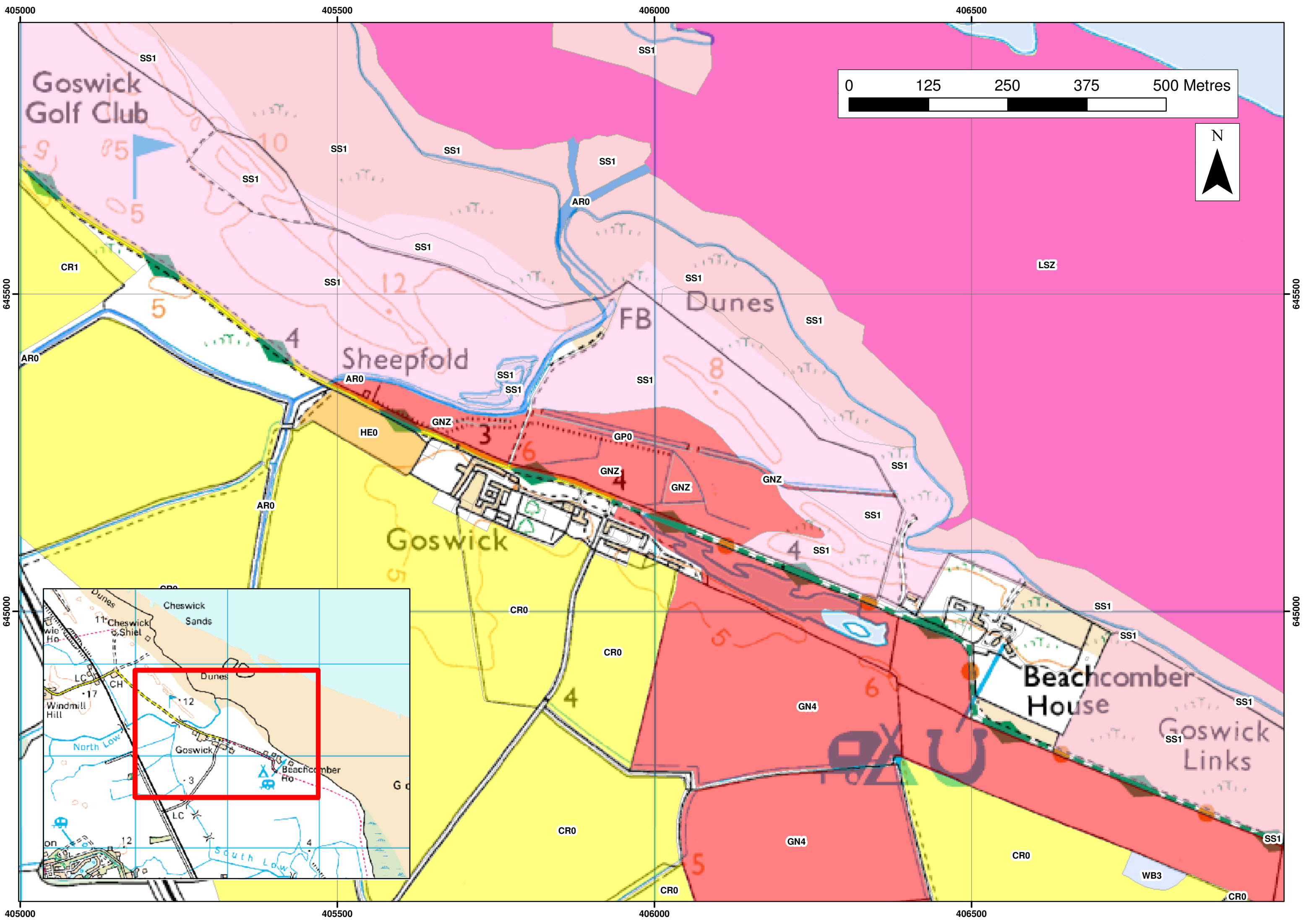
SS1

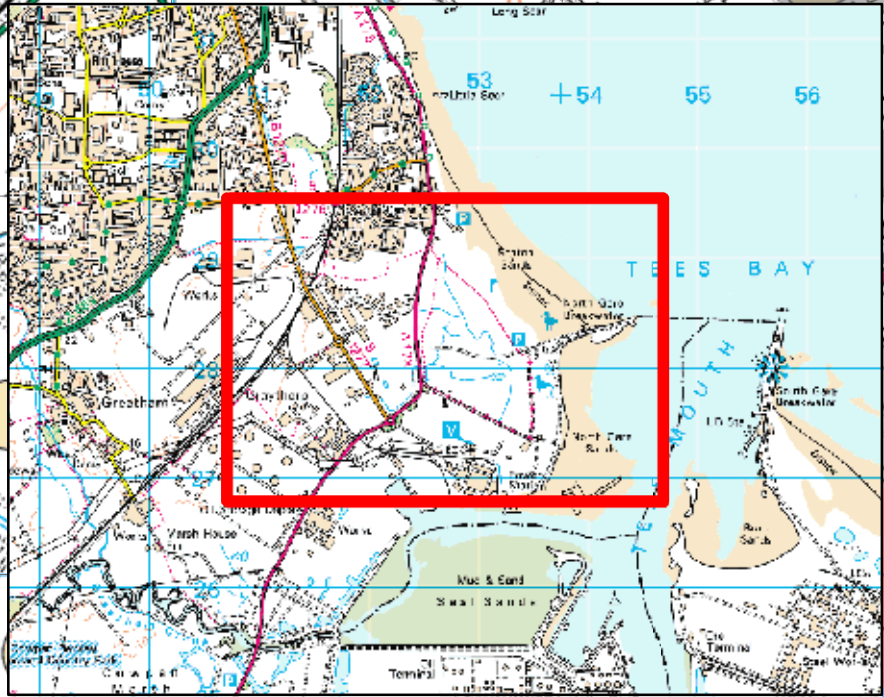
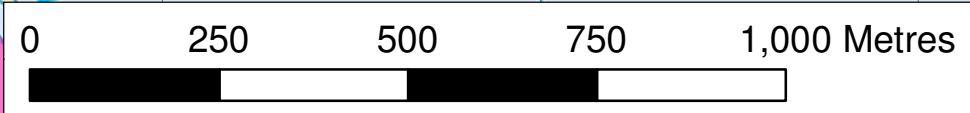
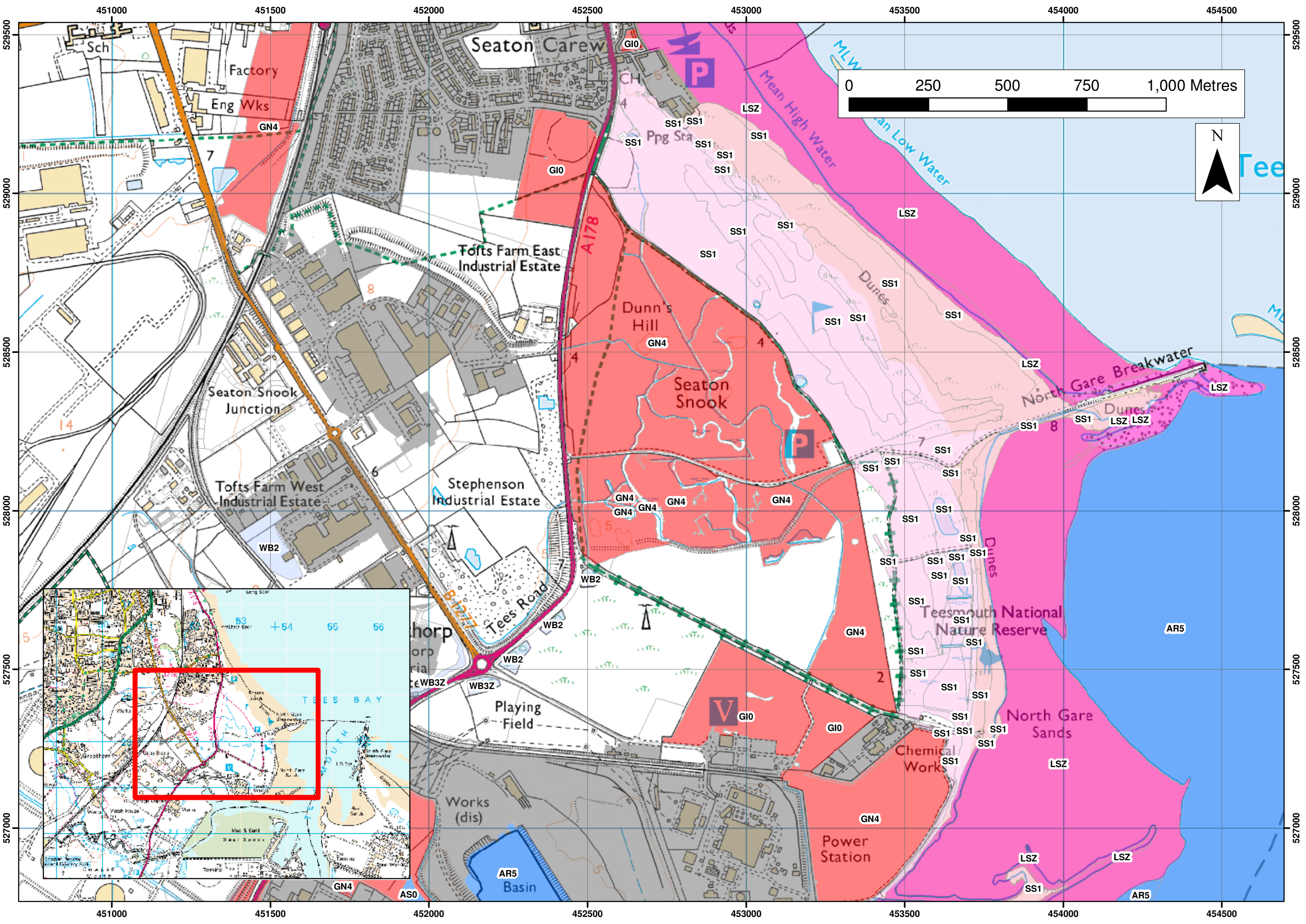
LSZ

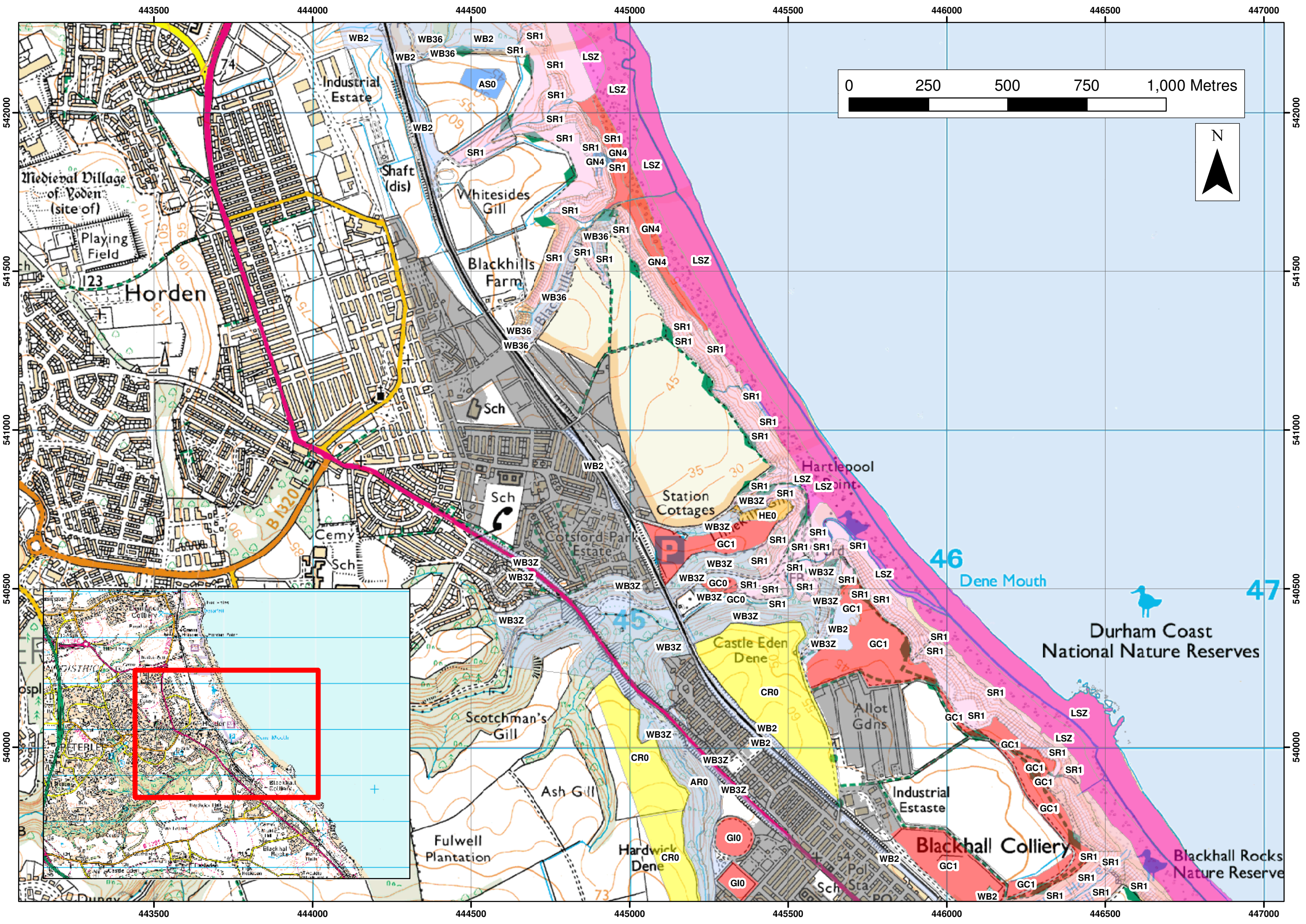
LSZ

LSZ

LSZ





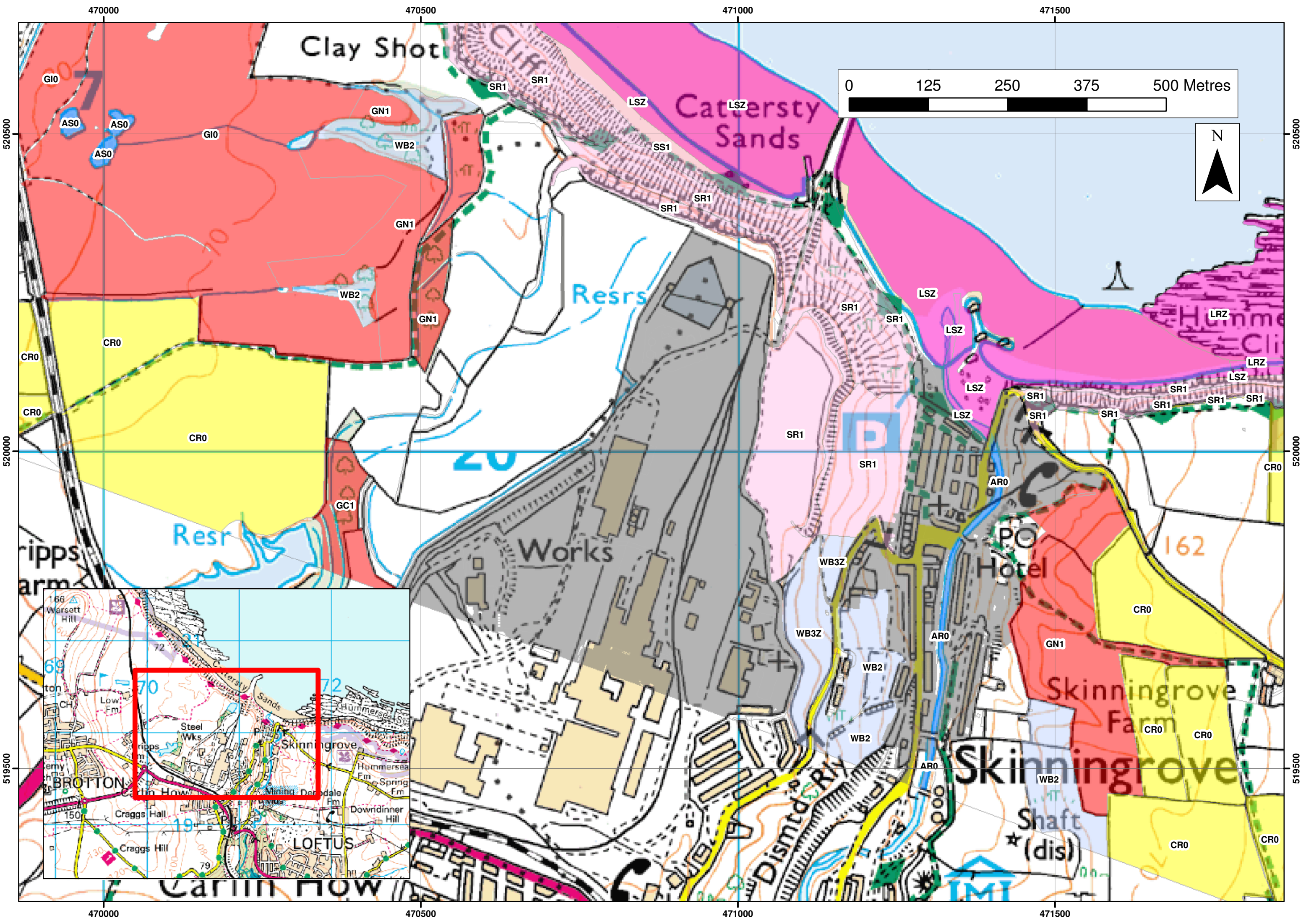


443500 444000 444500 445000 445500 446000 446500 447000

542000 541500 541000 540500 540000



443500 444000 444500 445000 445500 446000 446500 447000



Clay Shot

Cattersty Sands

Resrs

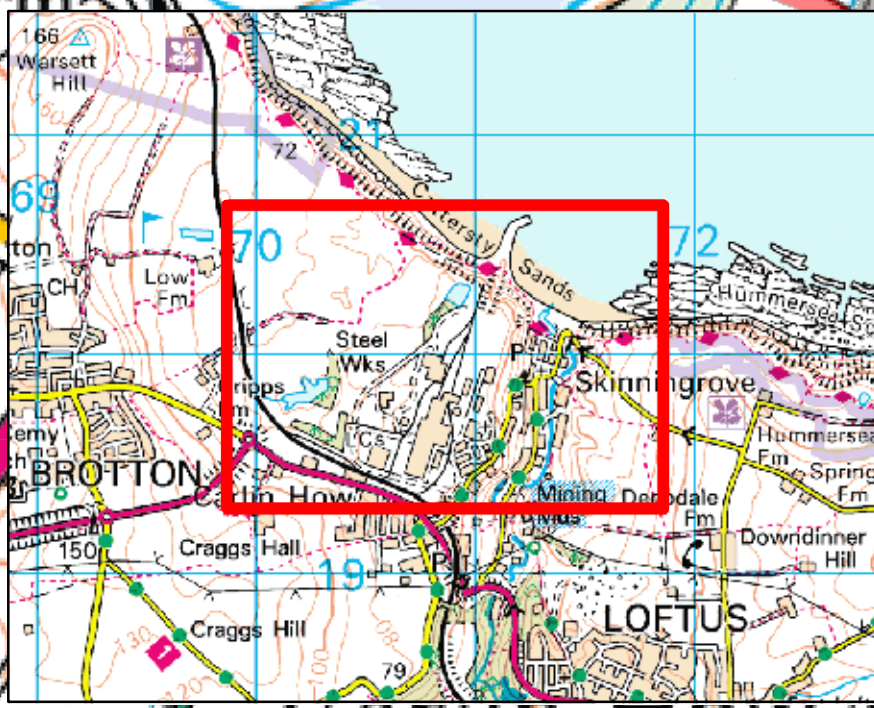
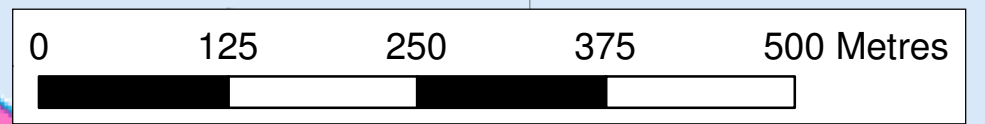
Works

Hotel

Skinninggrove Farm

Skinninggrove

Shaft (dis)



470000

470500

471000

471500

520500

520000

519500

470000

470500

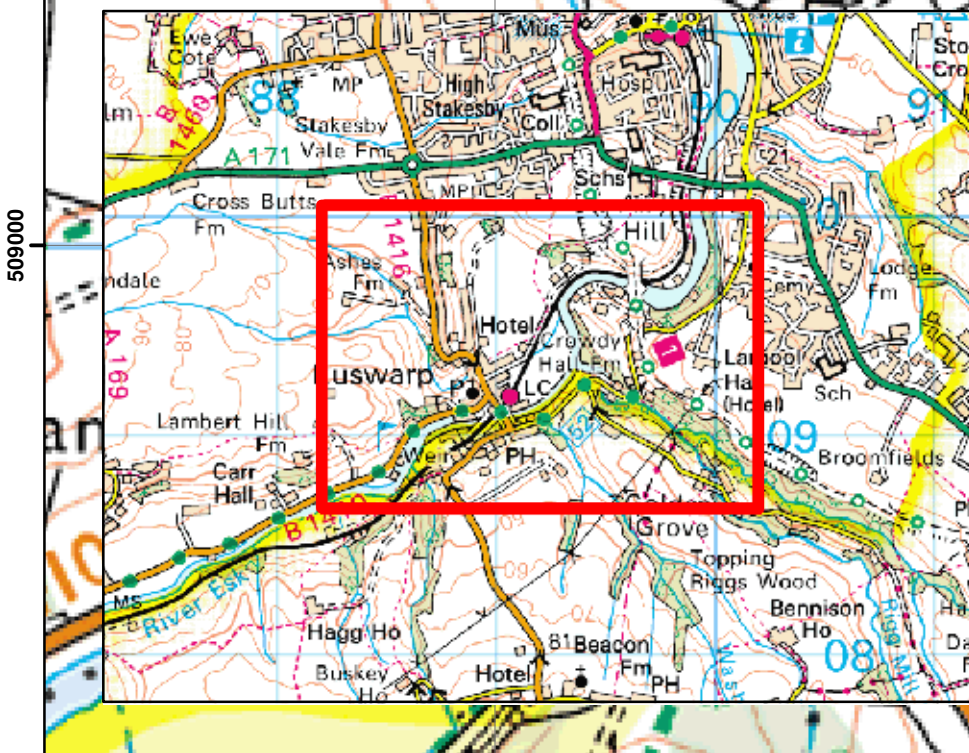
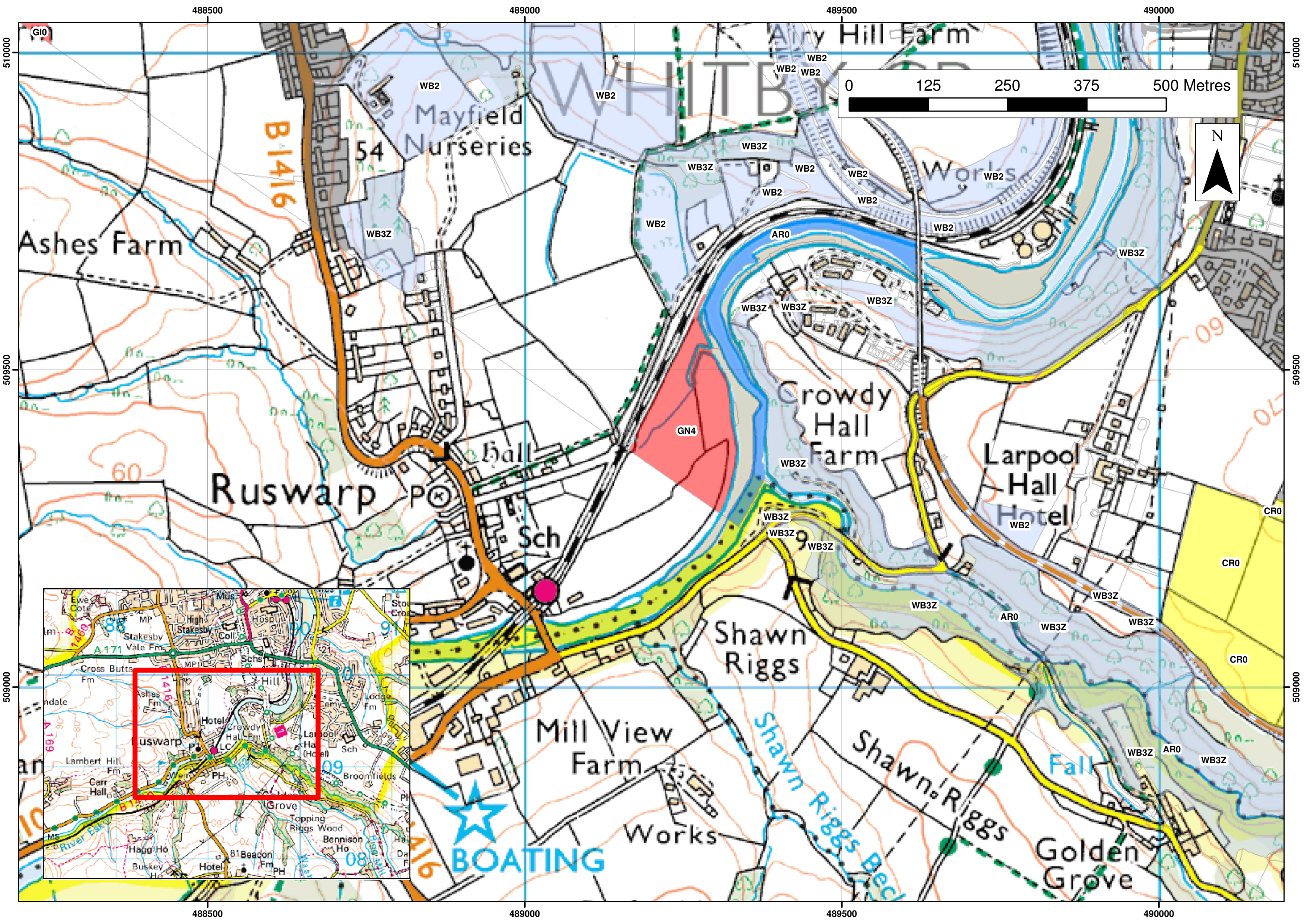
471000

471500

520500

520000

519500



The logo consists of a blue five-pointed star above the word 'BOATING' in a bold, blue, sans-serif font.

