

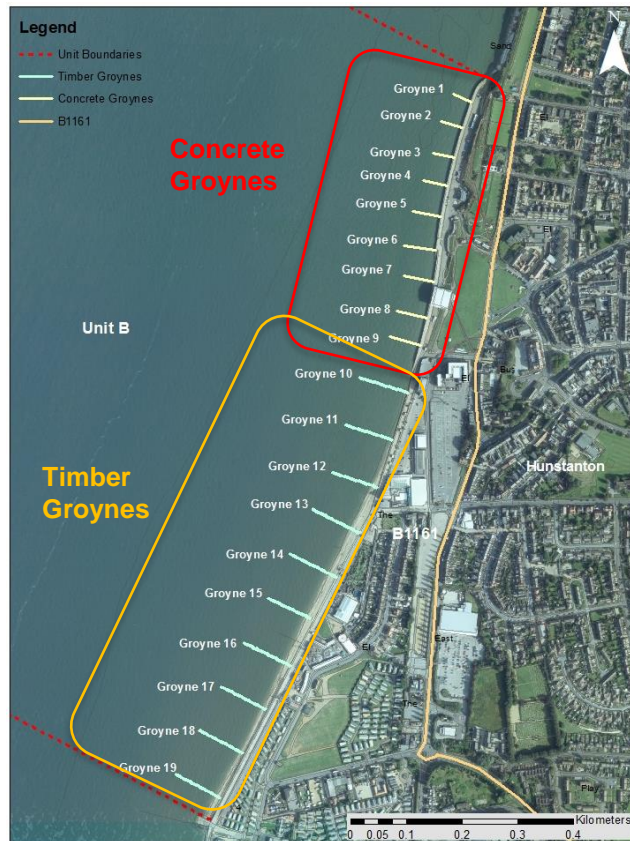
# Jacobs Groyne Effectiveness Report

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Borough Council of  
King's Lynn &  
West Norfolk



# BCKLWN Frontage



# Concrete Groyne Frontage

- Concrete – unusual material choice
- Condition 'Poor' to 'Very Poor' throughout
- Missing planks etc but main structural issue is due to beach lowering below design levels, and abrasion



Groyne 4

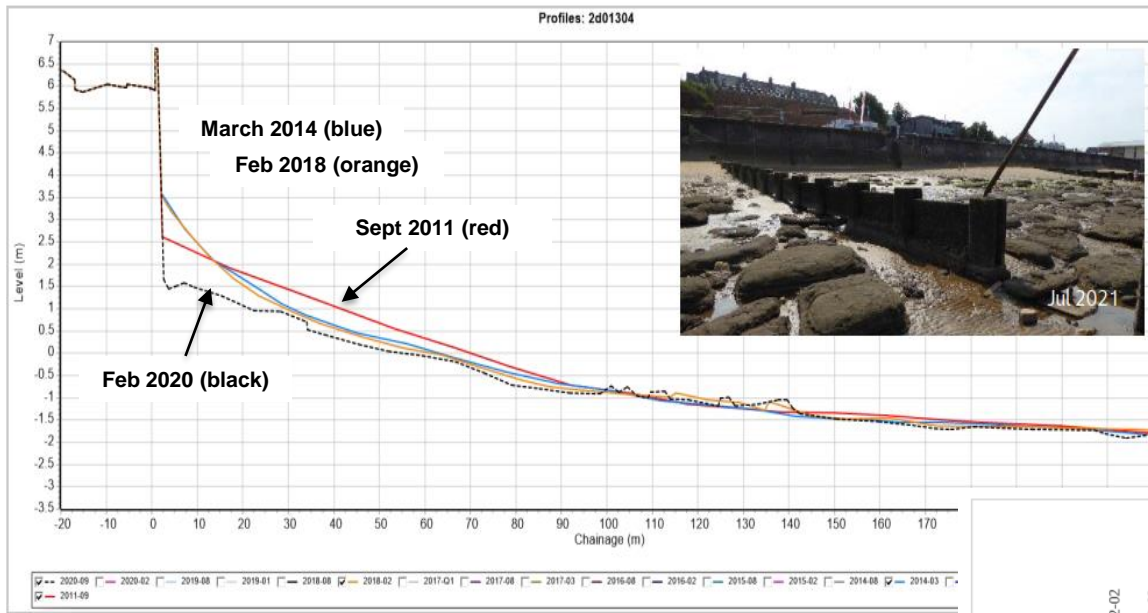


Groyne 7



Groyne 5

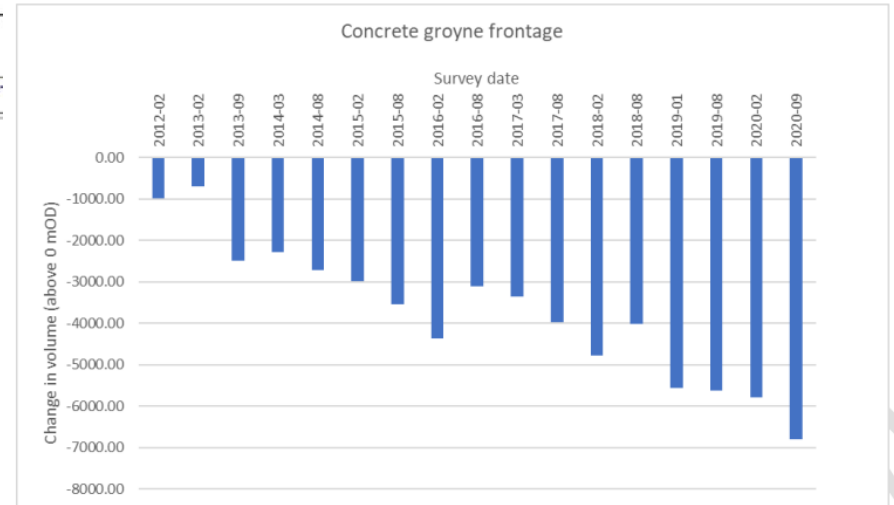




## Concrete groyne frontage

## Typical changes in beach profile

Change in beach volume above level 0mOD – relative to Sept 2011



# Concrete Groyne Frontage

- Sand is almost non-existent – little evidence that substantial volumes of sediment have ever regularly moved onto this shoreline
- Promontory & high exposure to waves – unlikely for sediment to be retained for very long, even if a reasonable input of sediment
- Little differential in level of any beach material across the groynes
- Elevation of the groynes is too low to be effective in front of a reflective seawall





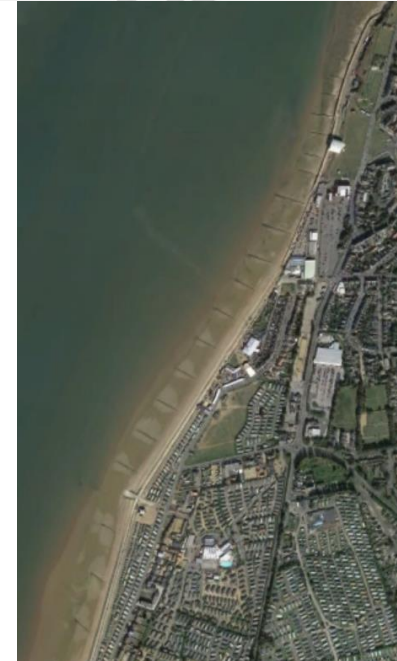
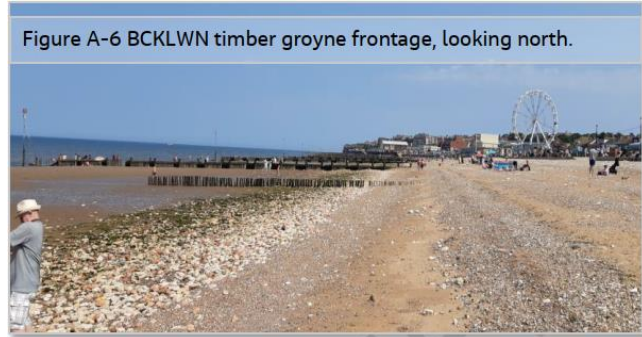
# Timber Groyne Frontage (BCKLWN)

- Permeable timber structures
- Condition 'Poor' to 'Very Poor' throughout
- Main structural issue is due to beach lowering and abrasion
- Rock has been added in places

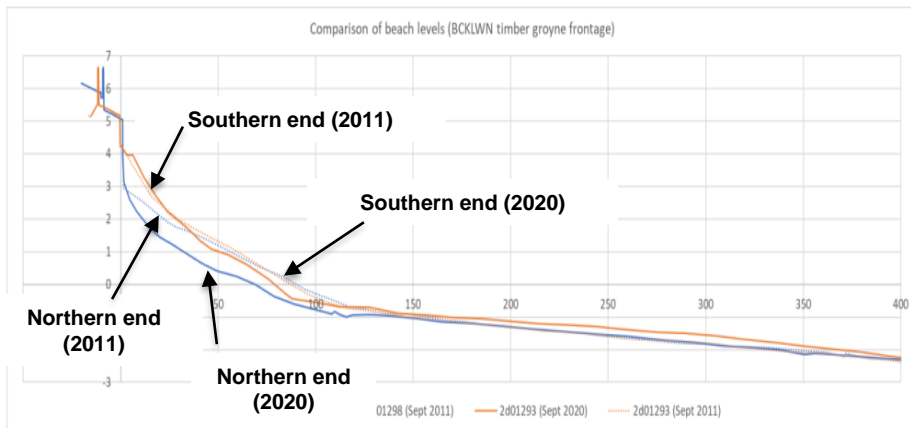


# Timber Groyne Frontage

- Steeper coarse upper beach – little sign of substantial contemporary supply
- Sandy lower intertidal beach.
- Seaward of the groynes lies a low tide sandflat.
- Little to no differential in beach levels across the groynes.
- Beach width increases from north to south, but more a function of the planform shape created by seawall alignments.



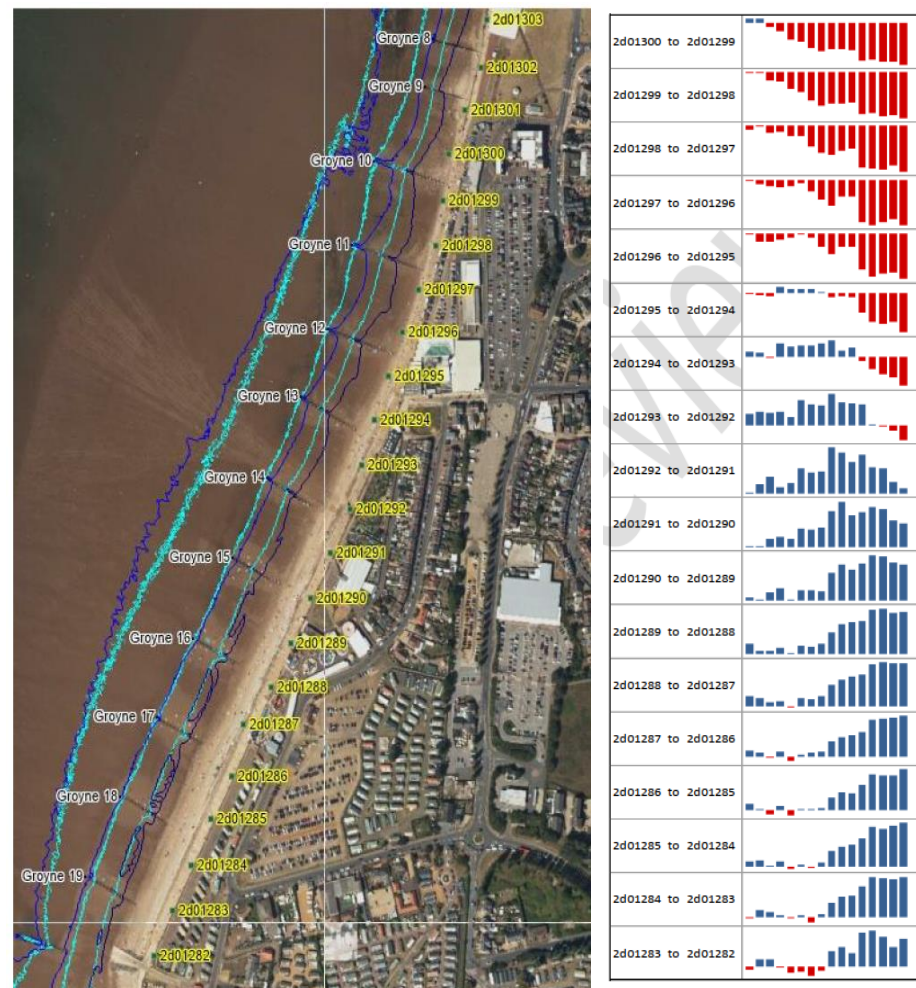
# Timber groyne frontage



## Contrast in beach response

Position of -1mOD, 0mOD and +1mOD contours in 2012 (light blue) and 2020 (dark blue)

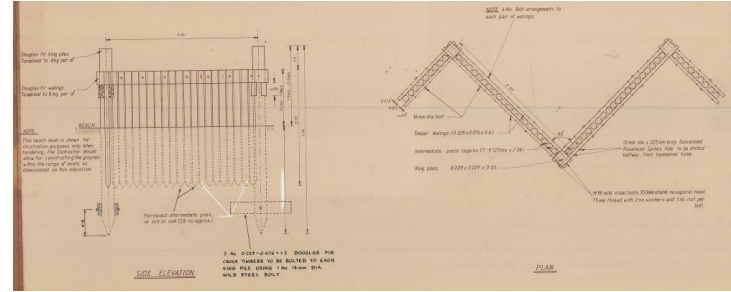
Sparklines show changes over time north to south for upper beach (above MSL)





# Timber Groyne Design

- Very unusual design – highly permeable
- Unlikely they were built with expectation of retaining sediments moved alongshore by waves!
- Lesser known but significant original objective for introducing groynes was to deal with tidal currents
- Function of permeable groynes
  - Also to help reduce the effects of alongshore currents and to act as a filter rather than as a blockade to longshore transport
  - They allow sediment to be transported through the groyne so to not create downdrift erosion.
- *SCOPAC 2010: “are permeable groynes an oxymoron?”*



# Timber Groyne Frontage (BCKLWN)

- By design, these groynes will not prevent wave-driven transport of sands
- But they may influence current flows across the lower beach, enabling deposition and retention of some finer sediment there
- Some possible evidence of this in the vicinity of the Power Boat Ramp
- But no evidence of any influence on the alongshore movement of the upper beach



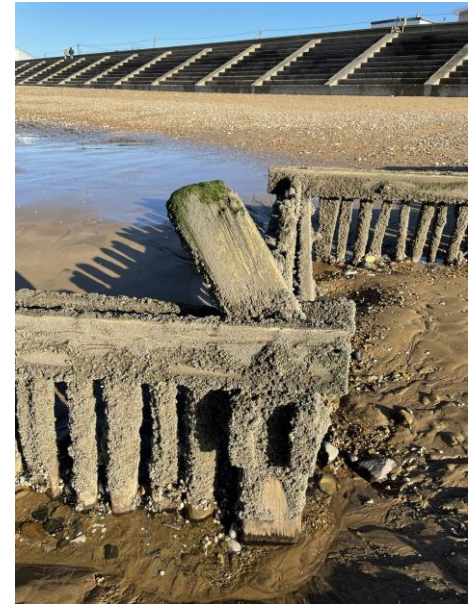
# Environment Agency Frontage





# Timber Groyne Frontage (Env Agency)

- Same design as those on Hunstanton town frontage
- Condition similarly 'Poor' to 'Very Poor' throughout
- More sand (in places) – but this frontage is also recharged annually





# EA timber groyne frontage

## Typical changes in beach profile

### Key to lines:

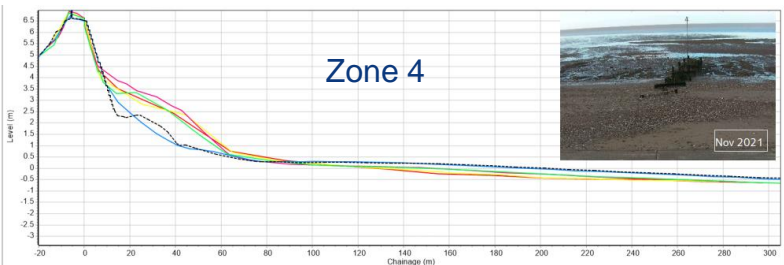
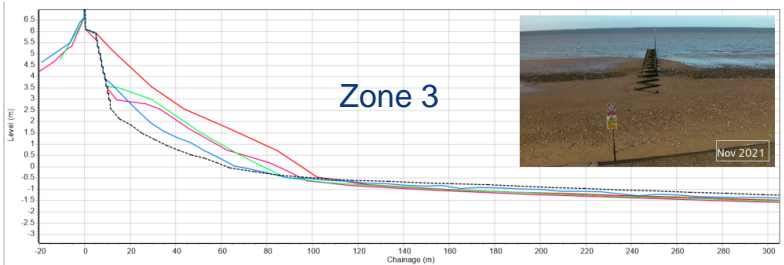
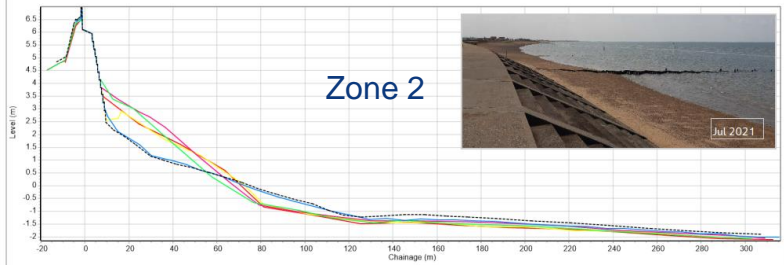
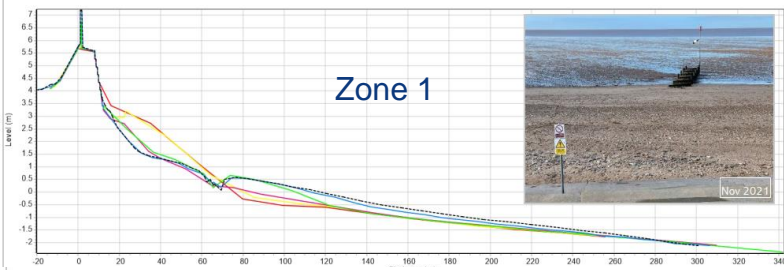
Blue = Feb 2014

Yellow = June 1992

Black = Sept 2020

Green = April 1997

Red = March 1992



	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	Net change	
zone 1	1,490	-4,254	1,443	-4,925	-58	-3,684	2,708	2,513	396	-68	-4,439	
zone 2	-2,205	-484	-1,513	-2,059	638	-561	-759	-1,022	-1,968	33	-9,900	
zone 3	-224	2,484	-498	-4,108	1,825	-1,717	371	-4,162	-1,162	-1,771	-8,962	
zone 4	-2,095	-430	1,467	-1,623	1,689	-1,851	1,727	2,609	343	-547	1,289	
Sum zones 1 to 4	-3,034	-2,684	899	-12,715	4,094	-7,813	4,047	-62	-2,391	-2,353		

Total overall 'natural' gain/loss of volume above 0mOD

# Timber Groyne Frontage (Env Agency)

- No differential in levels – groynes seem to be largely ineffective in respect of alongshore movement
- But again may be influencing current flows on lower beach, in particular in Zone 1.
- Zone 2 – promontory, toe of wall exposed and it clear that elevation of groynes is too low (if effective)
- Zone 3 – better beach – but groynes appear to have no discernible influence – due to alignment of seawall creating embayment
- Zone 4 – groynes clearly redundant

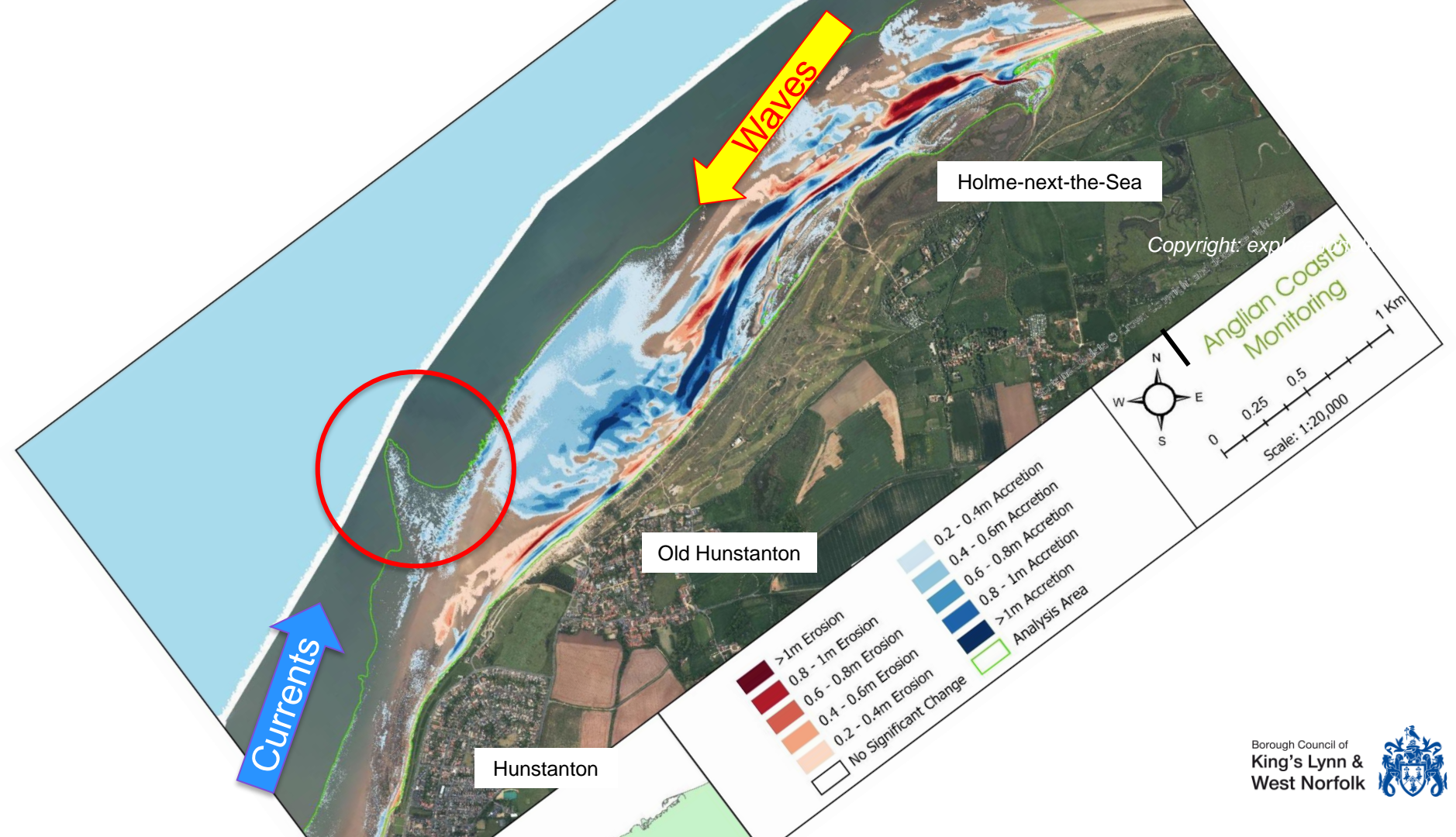


# Why does sand not reach Hunstanton beaches?





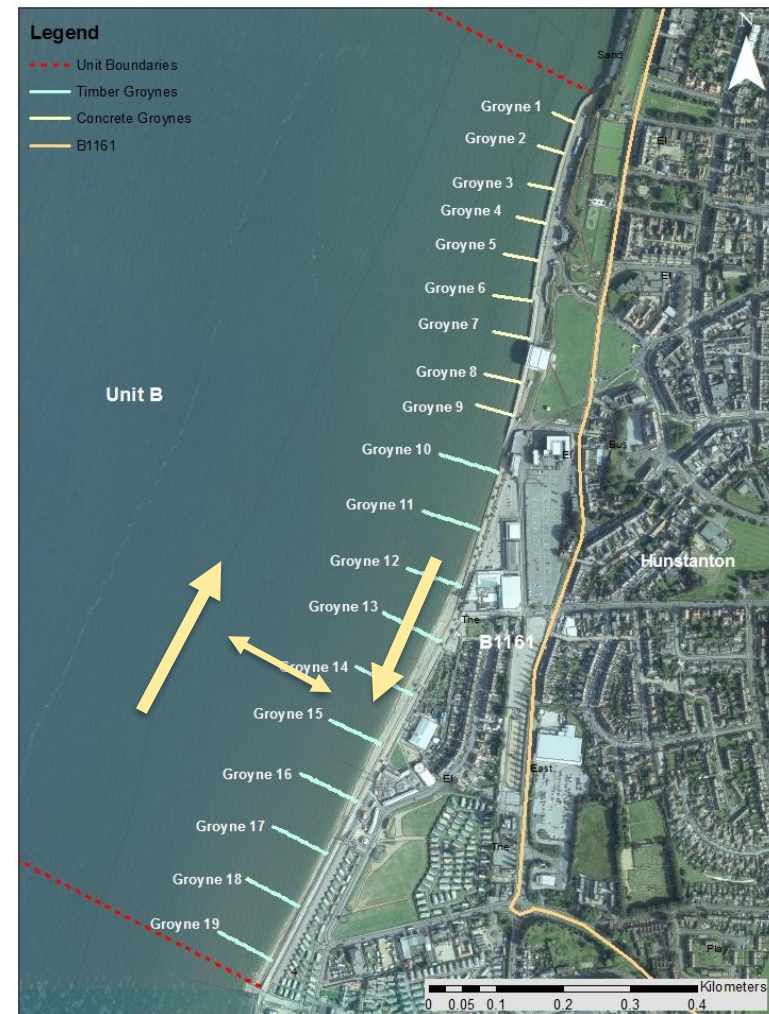






# Summary

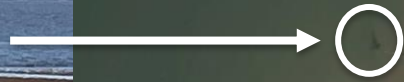
- Coastal processes limit the amount of sand that can reach the frontage
- What sand does reach the frontage gets moved away again – cross shore and alongshore







**Discharge further seaward  
tending northwards**



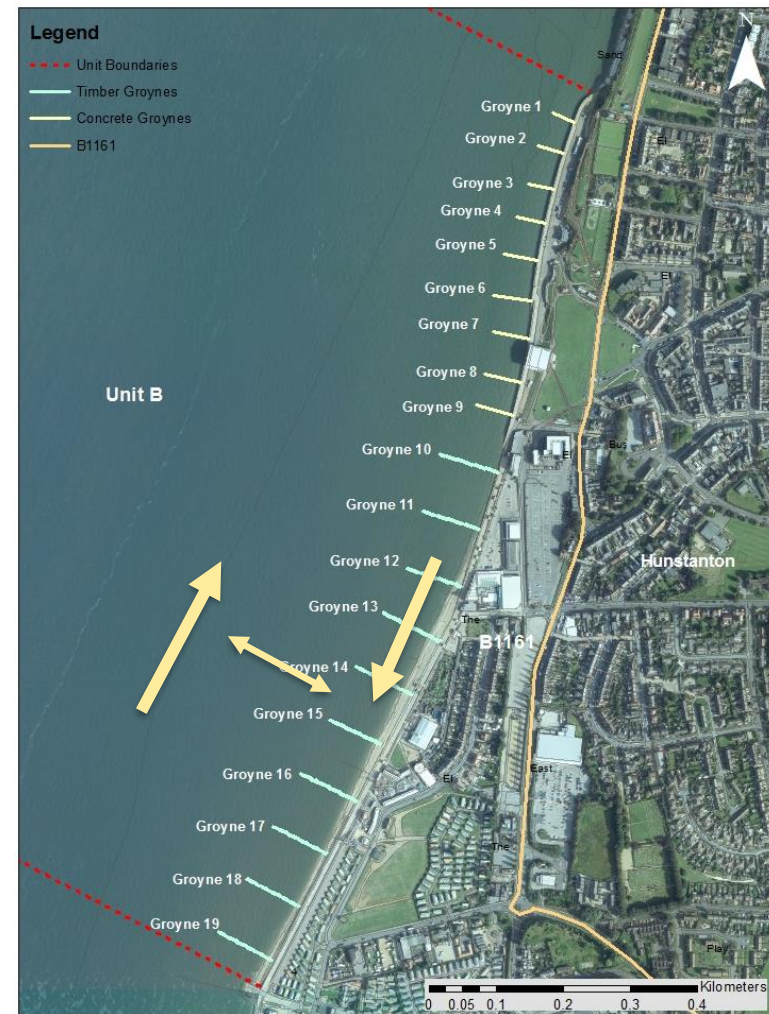
**Discharge further up beach  
tending southwards**





# Summary

- Coastal processes limit the amount of sand that can reach the frontage
- What sand does reach the frontage gets moved away again – cross shore and alongshore
- A groyned beach needs a regular feed of sediment to collect within the bays they form – without that any groynes are effectively redundant.



# Concrete Groyne Frontage

- A lack of beach sediment supply
- Cross-shore movement of material is evident – this will not be prevented by the current groyne structures
- Low water channel inshore of Sunk Sand sandbank close to shore – sand drawn down the beach can be moved away by tidal currents

Therefore:

- Even if the groynes were made higher and longer it is still unlikely that these would have much effect
- At the very least need a different form of groyne design and recharging, but effectiveness would still be questionable

# Timber Groyne Frontage (BCKLWN)

- Lack of sediment supply
- Sand-sized sediment will simply pass through these groynes.
- Limited effect on wave-driven alongshore transport
- By disrupting tidal flows across the beaches at mid to high water levels, may encourage less erosion/some limited deposition of sand (e.g. the four or five bays directly north of the Power Boat Ramp)

Therefore:

- With exception of southern end, reinstatement of these is unlikely to have significant effect – but they are not doing any harm either.
- Permeable groynes would still have the issue of insufficient sediment supply



# Timber Groyne Frontage (EA)

- Limited effect on wave-driven alongshore transport
- Groyne lengths do not appear to have a significant effect
  - Beach level comparison within Zone 2, between shorter groynes and longer groynes did not reveal any notable increase in beach width or level
- Possible influence of some groynes on tidal currents and transport
  - sand may be being retained between the groynes nearer the Power Boat Ramp.

Therefore:

- With exception of Zone 1, reinstatement of these is unlikely to have significant effect – but they are not doing any harm either.
- Sand recycling provides sediment supply to upper beach – retention against seawall might be improved if the landward sections were replaced with higher impermeable structures





# Conclusions

- 1) The groynes present along this frontage are largely ineffective in their current state.
- 2) Although groyne condition is a factor, their design, combined with an absence of sediment supply, means that effectiveness would remain limited even if rebuilt to an improved standard.
- 3) To have larger sandier beaches along Hunstanton frontage will require a different approach.



# Other options for a beach

If beaches required, then different and more effective options will be needed – for example:

- Larger and different structures to control the waves and currents that affect stability of the beach, e.g. to create more stable 'embayments'
- But lack of natural sediment supply will almost certainly also require beach nourishment
- Also ways to recharge without structures, e.g. mega-nourishment schemes

Note that these would required comprehensive assessments to determine likely effectiveness, costs, and potential implications of the redistribution of the sediment across the sensitive environmentally sites within The Wash

