Appendix 1 Instow Sand Dune Management Proposal

Brief

Instow has had a long term problem of sand encroachment onto the highway. Various measures have been used in the past with varying degrees of success. The beach currently oscillates about equilibrium or is steadily accreting and does not cause a problem at the moment; the dunes appear to be the main source of sand encroachment onto the highway at the north end of Marine Parade. A solution that is low cost, naturalistic and fits the setting of Instow and legal constraints is required.

Background

Instow Beach is a sandy beach that lies near the confluence of the Rivers Taw and Torridge. The beach has a history of varying in elevations, though over the latter several years the trend has been to increase to the point that sands spills from the beach over the highway and blocks springs, streams and surface water drainage. The beach has been known in living history to be some 2.2 m lower than the elevations seen today based on the knowledge of the “13 steps” down to the lowest known elevation.

Instow beach is owned in the main by Christie Devon Estates, there are other stretches of the foreshore owned by the Crown Estate. The beach generally is managed by Instow Parish Council under a foreshore lease from the stretches owned by the Crown Estate. The beach and dunes at Instow form part of the Taw Torridge SSSI.

Other beach uses include mooring for vessels and for flooded vehicle recovery exercises by the Marines based at Arromanches ATTURM camp at Instow.

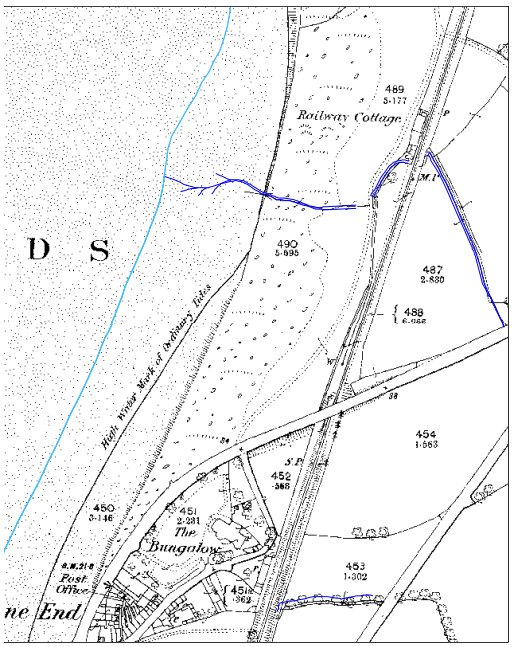
Fig 1. Instow Beach location on the Taw-Torridge Estuary, North Devon

The Process of the beach/dune development

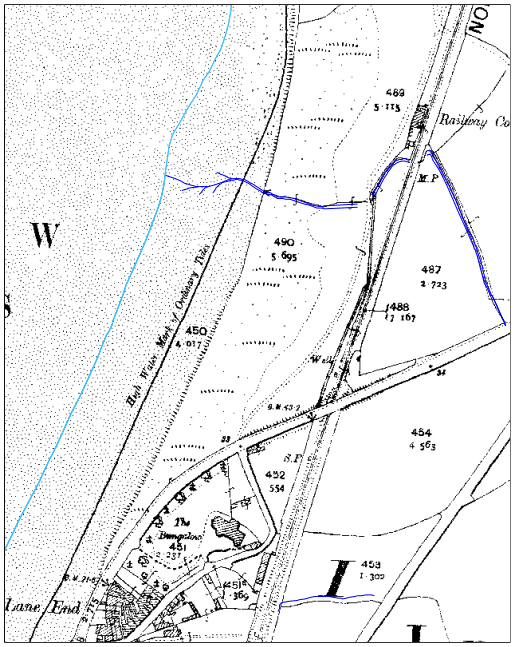
A sediment trend analysis carried out as research in the last manifestation of the shoreline management plan indicated that the sediment was migrating in through the estuary mouth from the beaches at each side of the estuary. This roll over of sediment from the mouth up the estuary is a typical natural response to sea level rise, and is considered to be important for the future sustainable management of flood and coastal defence in the estuary complex that this sediment remains in the system, including the dunes.

The Pethick report for the modelling of the estuary suggests that Instow is a flood delta and that there is ultimately a transport of sand from the ebb delta (acting as a reservoir) and back out to the estuary mouth in a counter-clockwise direction.

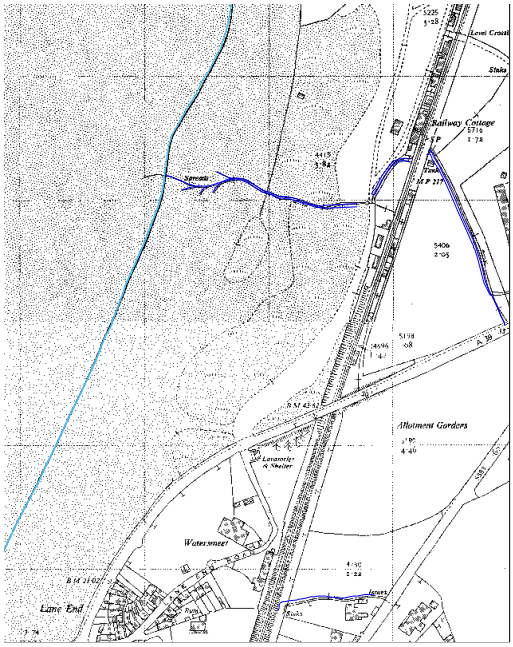
Historical maps (1880, 1920, post war edition 1954), current OS maps, LiDAR surveys (2006 and 2008) and aerial photographs (1947, 2000 and 2006) were considered to examine the historical development of Instow. The historic data show a continual accretion of the dunes from 1880, (apart from a period during the war when the MoD removed the dunes for their operations. There is a long slow an inexorable build up of the dunes by natural processes which will mean that the dunes will ultimately extend southwards along the beach and sea front. Though not immediately recognised by some, this is an asset to the coastal and flood defence of the village that will be needed over the coming 100 years, if the accretion continues.



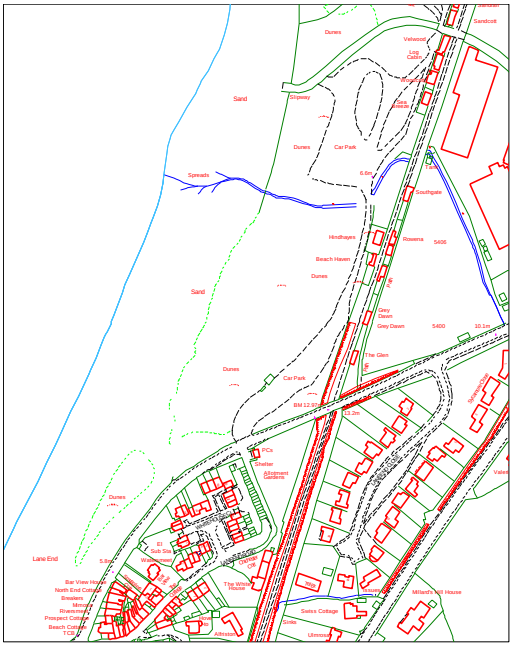
a) 1880 OS map



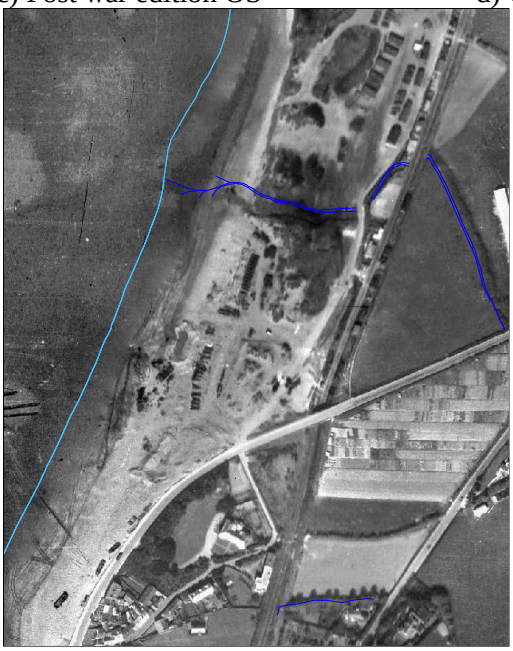
b) 1905 OS map



c) Post war edition OS



d) Current OS (2006)

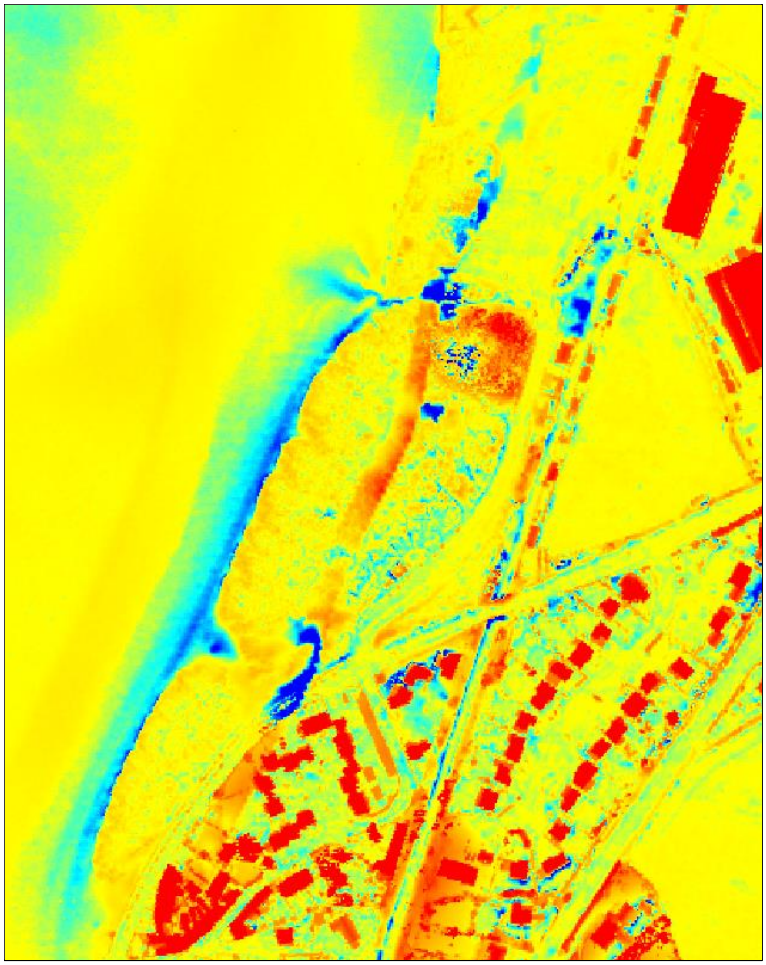


e) 1947 RAF Aerial Photo

f) 2000 Aerial Photo

g) 2006 Aerial Photo

The historic data show a continual accretion of the dunes from 1880, (apart from a period during the war when the MoD removed the dunes for their operations. There is a long slow an inexorable build up of the dunes by natural processes which will mean that the dunes will ultimately extend southwards along the beach and sea front. Though not immediately recognised by some, this is an asset to the coastal and flood defence of the village that will be needed over the coming 100 years, if the accretion continues. The Pethick report predicts a widening of the estuary at this location over the coming 100 years. Given Appledore's hard sea defences, it is likely that most of the widening will happen on the Instow side of the river.



h) difference in 2006 and 2008 LiDAR flights. (red is accretion, blue is erosion, yellow is neutral)

Past practices

In the past when the sand was over topping the wall, an aggregate extractor was allowed to take the sand away for commercial use at a no fee basis. This now contravenes the Mineral plan policy for the estuary and SSSI, for the reasons stated above.

In 2003 dune fencing provided an effective solution in filling the existing blow outs and raising the dune crest. In 2004 the main beach was planed down and sand removed to the north beach to nourish those dunes. The planing has resulted in the main beach maintaining equilibrium, though culverts need to be cleaned at occasional intervals. Sand has been moved on more than one occasion from the southern end of the dunes to the main face of the dunes to alleviate encroachment.

The sand has now reached a level where it is spilling over on to the highway again especially at the southern part.

The approach to the problem should therefore be one of managing the location of the accretion. The analysis of the sand movement directions suggest that the areas where management should be effectively focused are shown with the black line on figure 2.

Fig. 2 Area of Instow sand dunes that need management

Management options for the dunes

Various management strategies have been used at Instow including sand extraction and dune fencing. Sand extraction is an efficient method of removing excess sand and lowering the height of the beach. It is an effective method on a short term basis yet with the continual circulation of sand in the estuary it will mean that sand will need to be extracted regularly increasing the already high costs. With current policies the extracted sand will need to remain within the system and be deposited on top of the dunes.

Another management strategy: dune fencing will encourage the accumulation of sand on the shore side of the dunes. At Instow beach fencing both parallel and transverse to the shore is necessary to account for the dominant and cross sand-blowing winds. Depending on the positioning and spacing of the fences effectiveness will vary, figure 3 shows the recommended spacing by The Countryside Commission for Scotland (CCS, 1982).

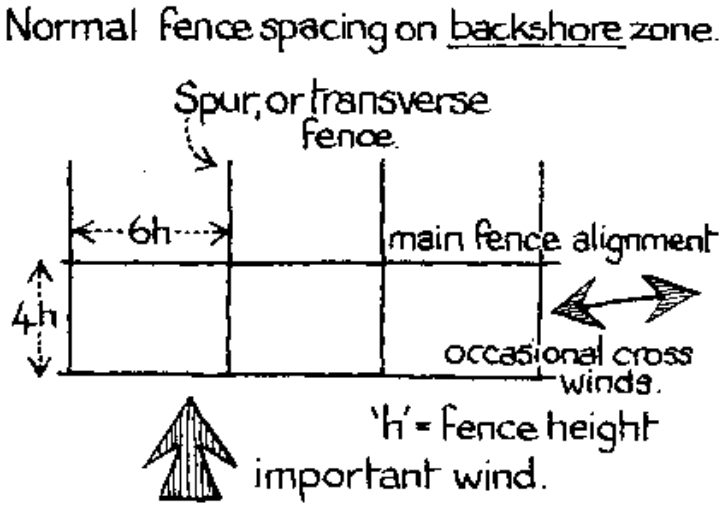


Fig. 3 Spacing of fences- plan view (Sand Dunes, 1979) and location with respect to HWM below

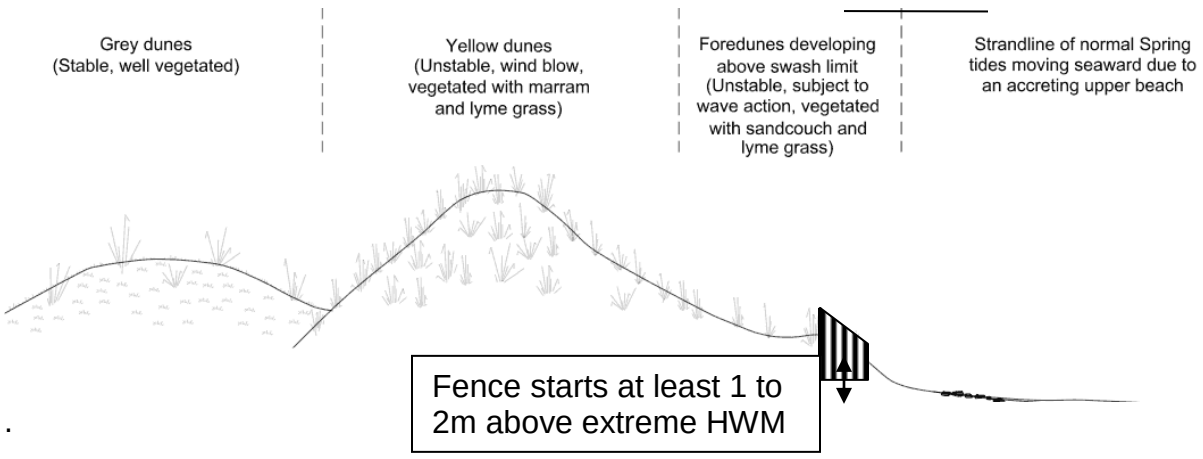


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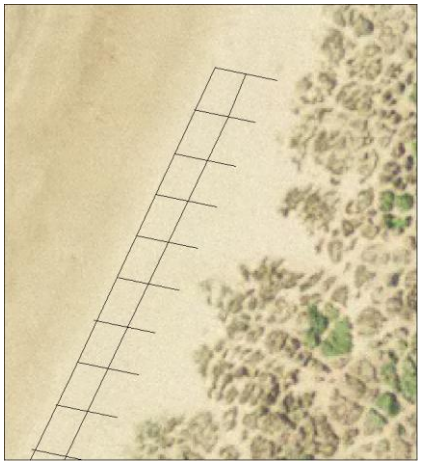
Table 1 shows the costs and benefits for the various management options at Instow.

Option	Description	Diagram	Cons	Pros
1 Do nothing	No management structure		Dunes will continue to move southwards and encroach onto highway. This incurs costs to the public bodies and h landowners. May lead to ultimate closure of the highway with wider economic costs.	Dune remains in its natural state.
2 Single row fencing	Single row of 1m high fencing positioned 2m above mean high water in a straight parallel row with 4m long transverse fencing at 6m intervals.		Cost of materials. Requires regular maintenance.	Sand will accumulate on the shore side of the dunes preventing dunes moving southwards or encroaching onto the highway. Some sand will be transported down shore so will remain within the circulation process. Reduces access so reduces trampling, erosion and destabilisation of dunes.

3 Double row fencing	Two rows of 1m high fencing positioned 2m above mean high water in straight parallel rows with 4m spacing and transverse fencing at 6m intervals.		Effective sand accumulation will result in sand being removed from circulation process. High cost of materials and requires regular maintenance.	Sand will accumulate on the shore side of the dunes preventing dunes moving southwards or encroaching onto the highway. Reduces access so reduces trampling, erosion and destabilisation of dunes.
4 Diagonal fencing	6m length fences set diagonally to the shore positioned 2m above mean high water.		Ineffective sand accumulation. Possible scouring in between fences in stormy conditions. Visitors able to walk in between fences possible erosion and destabilisation of dunes.	Sand will remain within circulation process. Low cost of materials.
5	Sand extracted from		Regular extraction	Immediate removal of excess

Relocation of sand	areas of accumulation: behind the dunes and south of the dunes. Sand relocated on top of dunes.		necessary, every 2 years. Not a long-term option. Very high costs. Does not fit with current policies of sand conservation and SSSI status	sand. Sand will remain within the circulation process.

Table 1 Management options for Instow

Recommended dune management option

We recommend option 2, single row fencing (fig. 4) it will permit sand circulation within the estuary and prevent the dunes encroaching onto the highway by accreting at the seaward edge and slowing down the build up of the dune ridge and overspill to the back of the dunes.

There are many different types of materials which can be used for dune fencing, the simplest, cheapest and most effective material supplied in the area are brushwood and chestnut paling. Past practice has also suggested that Biodegradable fence material can be used which is more effective and less likely to be a health and safety hazard. With limited local resources, the increasing cost of transporting and the high labour intensity of erecting brushwood fencing, biodegradable geotextile is the recommended material for dune fencing, see fig. 5. The fencing will require regular monitoring and maintenance and has a maximum life of 5-10 years. The fencing will need to be lifted and reused after sufficient sand has accumulated.

To assist the fixing of the sand, the natural strandline should be left along the face of these dunes with only hand-picking of plastic and human sourced debris.

In addition to the fencing, for the first few years occasional scraping behind the dune will be required to remove build-up of wind blown sand between the highway and dunes. The need for this will diminish as the dune advances. To improve sand accumulation we recommend that the natural strandline material is not removed. With these practices in place sand will accumulate seaward instead of along shore.

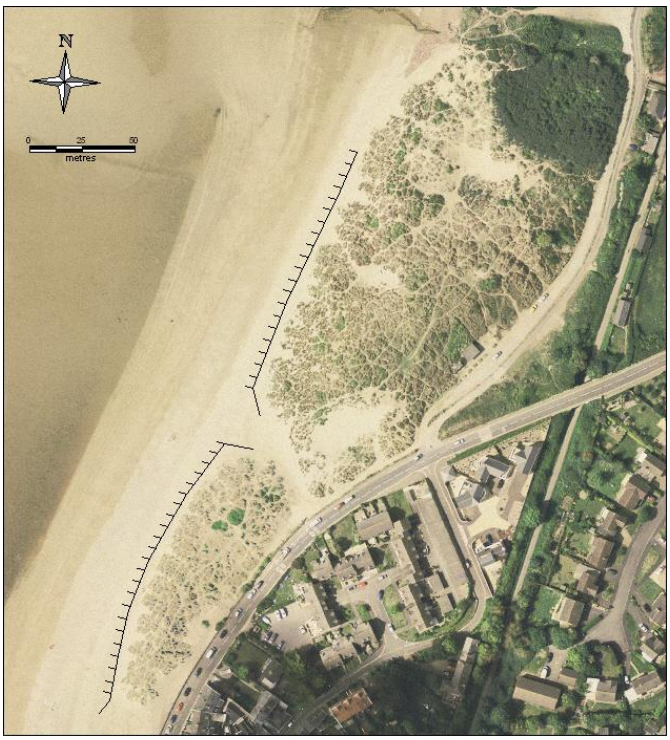


Fig. 4 Recommended management option 2, single row fencing

Costings

Dune management costs

Fencing - Plain wire 2 strands and biodegradable matting - approx. 470m of fencing required	£4700
Poles - poles needed every 3m	£800
Labour - local contractor rates	£3000
Supervision charge - free for first year charge for subsequent years	£500
Maintenance - removal and reuse of fencing once every year - general maintenance	£2000
Total	£11000

Table 2 Costings of management plan for first 5 years.

Beach Management element

The beach is oscillating about an equilibrium that occasionally requires small scale interventions to keep the culverts open to allow highway drainage.
Beach levels will need to be maintained by regular mechanical relocation of the sand, particularly away from the culverts and sea wall. This can be best and most cheaply done before it gets on to the highway. If it done at frequent enough intervals the volumes of movement will not be large and will not require large plant. To stop the beach from accreting, the strand line needs to be removed. In a SSSI, this is not desirable.

There is a culvert that allows the discharge of the stream emanating from the Downs Road area behind Instow, which crosses the Tarka Trail via an aqueduct. Currently the water discharged passes on to the Tarka Trail and will cause flooding on a fairly frequent basis because the pipe from the aqueduct to the beach is blocked. Releasing this water onto the beach via the pipe and culverts can be a control mechanism to maintain beach levels, because wet sand is more easily transported than dry sand.

Consideration may be given to installing a sluice control at the downstream end of the aqueduct and opening up the pipe to be used as a control to tweak beach levels and accretion rates. No costings have been calculated for this.

Costings for beach management

Based on historic costings the regular removal of sand along the beach front will be in the order of £10K- £15K per annum.

Next steps

The next step will be to arrange a consultation with local residents, land owners, local authorities, Natural England and the Parish council to discuss the management strategy and sourcing of funds.

Acknowledgement: NDABS wishes to thank Fiona Henderson who helped with this project as part of a work experience programme.