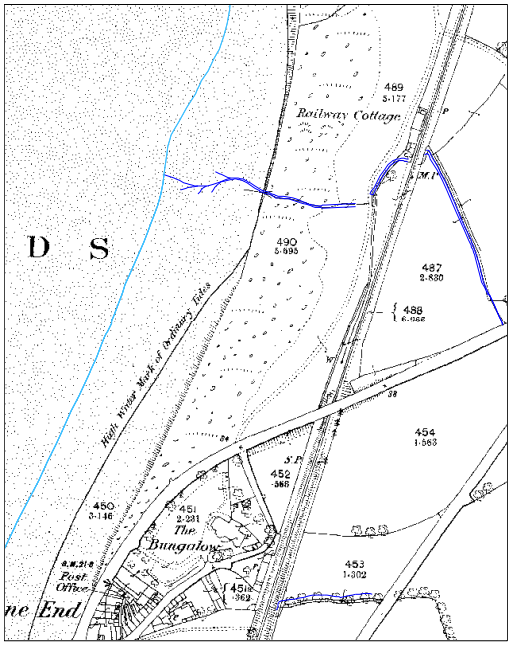
Instow dunes Options Appraisal

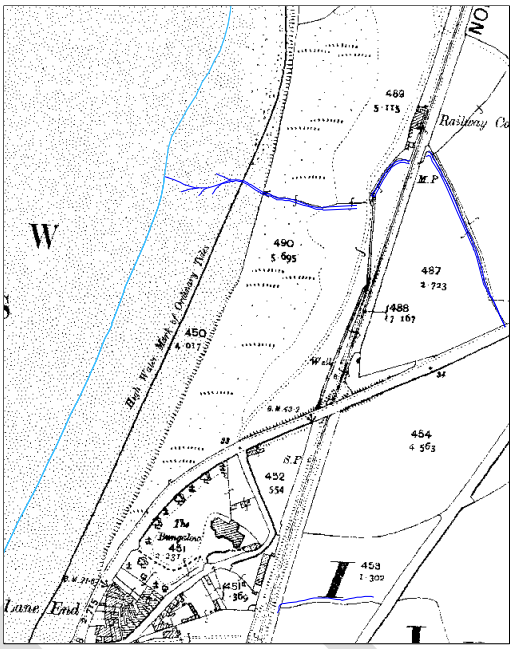
Purpose:
This document briefly explains the current state and problem of sand incursion on to the highway as presented at Marine Parade in Instow. The document lists several interventions that might be done and identifies the qualitative impacts likely to happen against each. The document concludes with 2 possible options to be taken for further investigation and costing.

Current state:
Sand accretes on the beach and has been building the dunes from the north of the beach that have been extending south since 1947 at least.

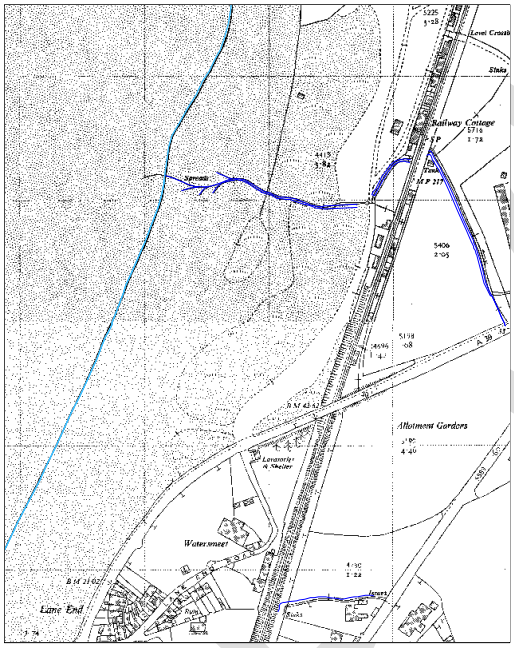
Figure 1 Instow beach circa 1920/30 and c1940/50 indicating the higher elevations at the north end of the beach.



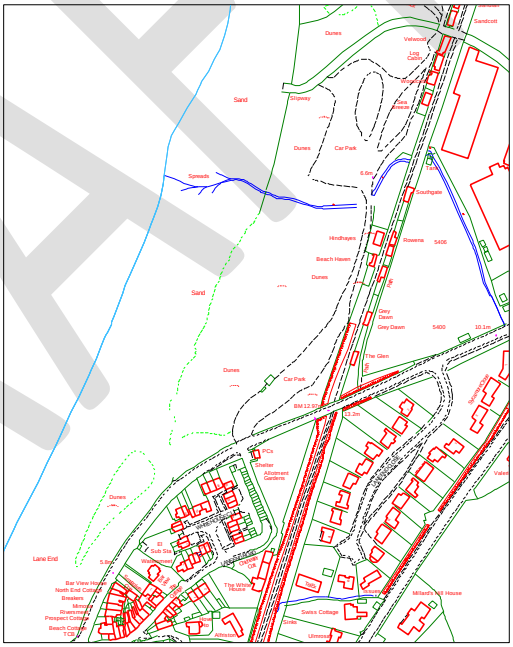
a) 1880 OS map



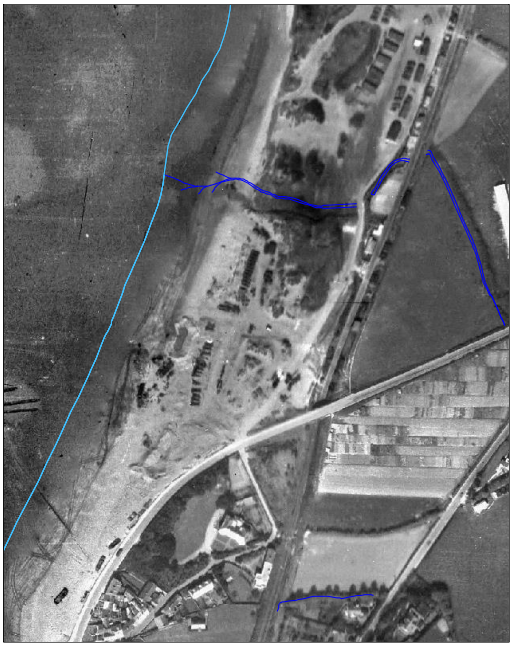
b) 1905 OS map



c) Post war edition OS



d) OS (2006)



e) 1947 RAF Aerial Photo

f) 2000 Aerial Photo

g) 2006 Aerial Photo

h) 2015 Aerial Photo

Sand accretes to the level of the wall and overspills on to the road. This creates a safety and amenity problem for the road and footpath users. The problem and risk have not been quantified. The assumption deployed in this paper is that the movement of people and vehicles around the sand will lead to an accident resulting in damage to property and potentially life.

Management in the past has involved cleaning sand from the road and disposing of it. Schemes have also involved planing down the beach level and removing the sand to the dunes to the north and locking the sand into the dunes. This has been problematic in that contractors have not put the sand into the dunes but have only stacked against the front face which leaves it open to premature erosion due to the foreshore not being equally elevated to dissipate energy and mimic a stable beach/dune profile.

Beach management practices were advocated that would lead to differential accretion in front of the existing dunes and less on the beach. This was to be done through the removal of all strandline material on the marine parade beach and leaving only a natural strandline (handpicked for plastics and litter) in front of the dunes. This practice was applied very briefly but not for very long.

Devon highways have raised the invert levels of the surface water drains expelling on to the beach to reduce the frequency and the depth of sand removal to allow free drainage.

The sand accretion is natural process that the landowner cannot be held entirely responsible for provided some reasonable measures have been taken, as they have done in the past. The flood risk in the area is from surface water collecting on the highway arising partly from blocked or tide-locked drains and overspill from the waves hitting the wall in certain circumstances. (high tides, large incidental waves low beach levels to dissipate the waves).

The sand provides a natural flood defence function that reduces tidal and wave energy throughout the estuary system as well as on the immediate beach front. It is for this reason the policy of removal of sand out of the system completely cannot be entertained since it will save costs on flood defence in the future.

The beach up to the highway wall on Marine Parade is SSSI. Therefore, there is a presumption towards natural processes and the need to safeguard features of the SSSI (mud and sandflats, mussels, over wintering birds, saltmarshes. The dunes are an implicit feature of the SSSI and there is a clear interaction between even the non-SSSI dune areas and the actual delineated SSSI. Any prescription will be subject to appropriate consents regarding the SSSI.

This paper is to provide an initial exploration in to options to reduce the sand encroachment onto to the highway. The impacts are qualitatively scored by (+) being positive and (-) being negative.

The Options

1. Do nothing
   1.1. Allow sand to continue to spill onto road, no interventions
   1.2. Impacts
      1.2.1. Dunes likely to accrete next to the road and therefore exacerbate issues in the future - -
      1.2.2. Continued risk to carriageway users (vehicular + pedestrian) due to hazards created by sand on pavement and road - -
      1.2.3. Increased risk of highway closure as a pubic road (Vehicular)-
      1.2.4. Close the highway as a public road i.e. not maintainable at public expense leading to economic impact in the village - -
      1.2.5. Surface water flood issues due to sand blocking egress to the beach -
      1.2.6. The sand that spills onto the highway still needs to be removed if it remains open, therefore it is not a no-cost option.

2. Keep re-locating the sand
   2.1. Continual removal of sand from road to the dunes for later incorporation into the estuarine system. Sand is removed mechanically and then transported into the dune system, on top or at the back of the dunes. Due to costs and available machinery, contractors had previously placed the sand in front of the dunes, leaving it exposed to the wave attack and remobilisation. High costs of disposal of sand were incurred in recent past due to advice that the sand may be contaminated and therefore not suitable for locating on the dunes. This may not be correct advice therefore if this is pursued it would be worthwhile to establish whether contaminants are within acceptable limits/not present; in which case local disposal will be cheaper.
   2.2. Impacts
      2.2.1. Periodic road passage and safety problems -
      2.2.2. Periodic surface water issues -
      2.2.3. Costs of removal of sand-(- -)
      2.2.4. Increased carbon footprint of works due to machinery used –
      2.2.5. Possible technical issues for sand deposition sites on/behind the dunes-
      2.2.6. Periodic impact to highway when clearance is undertaken (in addition to impact of the sand on the road, the plant used to clear it will likely require a road closure) -

3. Beneficial use of sediments;
   3.1. Extract the sand and use as recharge material in other parts of the estuary not benefitting from such strong sediment source. Sediment needs to match receptor sites requirements. Normal method is extraction while wet by a pump and then “sprayed” onto the receiver site.
   3.2. Impacts:
      3.2.1. Favourable habitat development at receptor site +
      3.2.2. System still benefits from the sand +
      3.2.3. Costs and benefits not available now to make a judgement but costs likely to be very high - - -

4. Train the dunes
   4.1. Allow the dunes to accrete but away from the highway. Infrastructure such as dune fencing will be needed.
   4.2. Impacts
      4.2.1. Dunes extends southwards along the beach improving coastal resilience +
      4.2.2. Dunes extend seaward rather than landward ++
      4.2.3. Loss of intertidal area & possible movement of main channel of River Torridge towards Appledore –
      4.2.4. Reduced immediate access on to the beach -
      4.2.5. Increase in the scale and diversity of natural habitats + +
      4.2.6. Some sand removal and highway maintenance is likely to be needed though at lower levels -

4.2.7. Loss of views across the estuary to Appledore by local residents -
4.2.8. Marine Parade wall will have extended life + +
4.2.9. May impose extra maintenance costs to modify the profile of the beach at the southern end to keep prevent run-up against the wave return wall in front of Marine Court Flats; but unlikely. -/+
4.2.10. Culvert at Boathouse end of the beach will be permanently blocked. This is a relatively small catchment therefore re-routing to the surface water drains may assist -/+
4.2.11. Lower cost option in the long-term + + +
4.2.12. Minimum carbon footprint of the operation + +
4.2.13. Linked to long term FCERM guidelines and Defra Policy +

5. Beach wetting
   5.1. Lower beach level to approximately MHW at the sea wall and keep it damp with freshwater and surface water discharge to reduce windblown sand and saltation
   5.2. Impacts
      5.2.1. Increased wave energy hitting the wall - -
      5.2.2. Beach less usable at high tide 50% of the time - -
      5.2.3. Overtopping rate increase at very high-water tides and wave splash over the top of the wall. - -
      5.2.4. Risk of not enough water to keep the sand damp and reduce the natural saltation of sand. - -
      5.2.5. Some maintenance needed to ensure the surface water drains deliver and disperse enough water. –
      5.2.6. Overall reduced cost ++
      5.2.7. Increased inter-tidal area +
      5.2.8. Potential loss of visitor use -

6. Forced recirculation;
   6.1. Move the sand onward in it's long term circulation route within the estuary. This could mean moving the sand at regular intervals towards the main channel
   6.2. Impacts:
      6.2.1. Mechanism is uncertain - -
      6.2.2. Real circulation route is uncertain -
      6.2.3. Impacts on navigation - -
      6.2.4. Impact on Appledore quay, fish dock and shipyard would need to be taken into account. - - -

7. Increase the height of the beach wall
   7.1. Increase the height (and width) of the wall against the beach to contain the sand
   7.2. Impacts
      7.2.1. Limited effectiveness in medium term as sand reaches the new level of the wall - -
      7.2.2. Cost of re-engineering the wall is likely to be significant - - -
      7.2.3. Detract from the amenity of the area - - -

8. Remove the sand off site
   8.1. Allow commercial extraction of sand within limits.
   8.2. Impacts
      8.2.1. Loss of sand from system for future coastal resilience - - -
      8.2.2. Need to upgrade defences sooner is more likely - - -
      8.2.3. Risk of increasing flood risk in a number of locations within the system due to permanent removal of sediment. - - -
      8.2.4. Does not match established policy - - -
      8.2.5. The Sea Sand (Devon and Cornwall) Act 1609 has been superseded by various other Acts and is not relevant. Further, the sand at Instow has less than 25% of the lime content compared to the sand at Fistral.
      8.2.6. If it were legal it would be cost neutral + +

9. Dredging the Estuary

9.1. Removal of sediment material in the mouth of the estuary before it reaches the beach
9.2. Impacts
    9.2.1. Loss of sand form the system - -
    9.2.2. Increased cost of operation unless a suitable market for the material and or disposal site is found
    9.2.3. Increased tidal prism coming into the estuary leading to increased flood risk - - -
    9.2.4. Greater wave penetration in to the estuary increasing overtopping rates on defences - - -
    9.2.5. May increase sand coming into the estuary rather than circulating around the bay. (See report by Pethick 2008) - - -

Preferred Options.

Based on the above, the preferred options are:

- Continued but properly monitored relocation of the sand to elsewhere in the dune system. This is referring back to the original proposal in Appendix 1.

- Or training the dunes. Briefly described in Appendix 3.

Next steps.

Costed and more detailed designs will be developed for these options (see appendices)

Appendices
Appendix 1: Original Sand re-location option
Appendix 2; Example of dune training at Swansea Bay
Appendix 3 Dune training and scheme design proposal