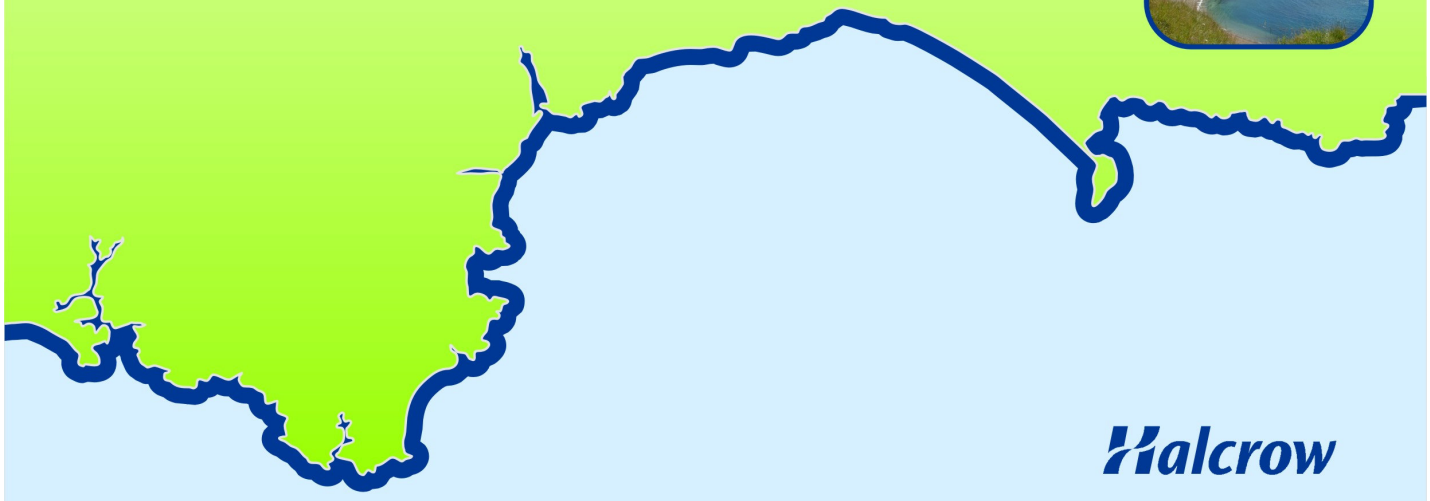
Draft Baseline Process Understanding: Annex A

Identification of Features or Issues where there is Direct Interaction between Estuaries and Open Coast Processes



Halcrow

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1 Introduction

This appendix to the Baseline Process Understanding report provides a summary of the interactions between the estuaries along the SMP2 shoreline and coastal processes.

2 Assessment

The estuaries reviewed in completion of this task where those identified in the Durlston Head to Rame Head SMP2 Scoping Report (June 2007). The identification of issues was primarily based upon a review of information contained in Futurecoast (2002), however a number of smaller features are not discussed in Futurecoast and as such assessment has been based upon a review of Futurecoast aerial photography and OS mapping. Where available, a number of other studies have been use to supplement the information from Futurecoast. Table 1 provides a summary of the interaction between estuary and open coast processes.

Table 1 Summary of Estuary-Coast Interactions

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
Lynher	238330	61340	Feeds in to the Tamar and is part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea. *(Futurecoast, 2002)*
Tamar	243694	71134	Part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea. *(Futurecoast, 2002)*
Plym	251753	57094	Feeds in to the Tamar and is part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea. *(Futurecoast, 2002)*
Tavy	247441	65038	Feeds in to the Tamar and is part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea. *(Futurecoast, 2002)*
Tamerton Lake	246545	60925	Feeds in to the Tamar and is part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea (*Futurecoast, 2002*).
Tiddy	234780	59500	Feeds in to the Lynher that in turn feeds into the Tamar and is therefore part of the larger 'Plymouth Estuary' system that has little impact on coastal processes with little sediment exchange between the estuary system and the sea (*Futurecoast, 2002*).
Yealm	256663	50956	Some sand flats at the mouth but generally low river flows with very little suspended sediment.

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
			Entrance exposed to south-westerly waves, though is partially sheltered by Great Mew Stone (*Futurecoast, 2002*).
Erme	263070	51596	Sandy at the mouth which is very exposed to south-westerly waves (*Futurecoast, 2002*).
Avon (Devon)	270071	47240	Sand deposits at the mouth and includes some short sections of sand dunes. Mouth is sheltered from south-westerly waves by Burgh Island, which has led to the development of a tombolo in the lee of the island (*Futurecoast, 2002*).
Kingsbridge Estuary	273551	44009	Sand accumulation in bays at the mouth. There is also a sand bar seaward of the mouth. Most sediment input is fluvial, with very little from sea (*Futurecoast, 2002*).
Bowcombe Creek (Kingsbridge Estuary)	274848	44109	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Frogmore Creek (Kingsbridge Estuary)	277517	42613	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Southpool Creek (Kingsbridge Estuary)	277439	40100	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Waterhead Creek (Kingsbridge Estuary)	276988	38850	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Collapit Creek (Kingsbridge Estuary)	272807	42198	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Blanksmill Creek (Kingsbridge Estuary)	272672	40982	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Batson Creek (Kingsbridge Estuary)	273518	39712	Creek feeds into the Kingsbridge Estuary therefore see notes above for 'Kingsbridge Estuary'.
Slapton Ley	281876	44067	Lagoon feature with no direct interaction with the sea due to being enclosed by a shingle barrier beach (*Futurecoast, 2002*). There is seepage from Slapton Ley through the barrier towards seaward due to the shingle barrier causing the water level in the lagoon to be maintained at an artificially high level above mean sea level thus establishing an hydraulic gradient (*SCOPAC Sediment Transport Study 2004*). Whilst there is no present direct interaction, should Slapton Sands barrier breach in the future, then this will change this situation significantly.

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
Dart	280079	61257	Very low sediment input to the coast despite relatively high discharge. No spit at mouth, rather entrance is flanked by high rocky cliffs *(Futurecoast, 2002)*. The high, resistant rock headlands that form the mouth of the estuary create a stable form that, together with a relative absence of coarse sediment around the mouth, exclude any interaction between the estuarine and littoral sediment environments (*SCOPAC Sediment Transport Study, 2004*).
Bow Creek	281222	56553	Feed into the Dart therefore see notes above for 'Dart'.
Teign	293404	90152	Spit extends across the mouth from the north has been fixed by development of Teignmouth, causing the channel to be diverted to the south and constricting flow through the mouth. Very mobile ebb tidal delta seaward of the mouth is in a cyclic sediment transport relationship with sand bars and beach to the north of the mouth (up to Sprey Point (*SCOPAC Sediment Transport Study, 2004*)), which also causes beach levels in front of Teignmouth to fluctuate as material moves around this system (*Futurecoast, 2002*).
Exe	293404	90152	Historically there were double spits at mouth of estuary that oscillated in growth, however at present only one is still mobile (Dawlish Warren) whilst the other has been fixed by development of Exmouth, thus making it a single spit estuary. Flood and ebb tidal deltas landward/seaward of these spits, form part of a complex sediment transport system (*Exe Estuary Coastal Management Study, Coastal Evolution Study (Draft), 2007*). Ebb tidal delta (Pole Sands) has a significant impact upon the coastal processes of a wide area and is also a store for large quantities of sediment (*Futurecoast, 2002*).
Otter	307569	83916	Spit extends across the mouth from the west causing the mouth to be diverted to the east where it is 'squeezed' against sandstone cliffs and rock platform (Otterton Ledge) (*Futurecoast, 2002*). Wave driven longshore transport moves shingle material into the river channel and this is then transported, by a combination of river and tidal currents, a short distance offshore to form an ebb tidal delta that has accumulated against Otterton Ledge. Wave action then moves shingle from the delta back onshore to the beach west of the entrance to the Otter, thus establishing a cyclic sediment transport pathway (*SCOPAC Sediment Transport Study, 2004*).
Sid	312909	87305	Largely trained along east side of Sidmouth, flowing out through an outfall. As a result has no significant impact on coastal processes (*Futurecoast, 2002*).

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
Branscombe Stream	320746	88173	Not included explicitly in Futurecoast (2002), so analysis here is based upon review of *Futurecoast Aerial Photos (2002)* and OS maps. This shows mouth is enclosed by shingle beach and so it is unlikely to have a significant effect on coastal processes. The permanent eastward deflection and damning of Branscombe Stream is due to net littoral drift eastwards (*SCOPAC Sediment Transport Study, 2004*).
Axe	325894	92268	Shingle spit extends across mouth from the west causing the mouth to be diverted to the east. At low water tide doesn't enter the estuary (it is 'cut off' by shingle beach/spit. At high river flows erosion and breach of the spit can occur forming a temporary inlet until it is closed by the re-forming of the spit by longshore drift. River inputs a small amount of gravel to the system (*Futurecoast, 2002*). Most material enters channel from seaward (driven by wave action) and this is then flushed offshore by river and tidal flow with material then moved back onshore by wave action (*SCOPAC Sediment Transport Study, 2004*).
Lim	334264	92071	Not included explicitly in Futurecoast (2002), so analysis here is based upon review of *Futurecoast Aerial Photos (2002)* and OS maps. This shows no obvious discharge of impacts and therefore it is not likely to have a significant influence on coastal processes.
Char	336635	93111	No significant impact on shoreline processes. A 20-30 year event can produce sufficient discharge to cause the river to erode a channel through the beach forming a temporary debris fan on the foreshore that is then pushed back by wave action to re-form the beach (*Futurecoast, 2002*). The gravel beach restricts discharge, such that during summer months the river is usually "ponded" upto 300m inland. In this case percolation through the beach occurs (*SCOPAC Sediment Transport Study, 2004*).
Winniford (Seatown)	342051	91793	Not included explicitly in Futurecoast (2002), so analysis here is based upon review of *Futurecoast Aerial Photos (2002)* and OS maps. This shows a small stream discharging of shingle beach but no significant impact upon coastal processes.

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
Eype	344782	90978	Not included explicitly in Futurecoast (2002), so analysis here is based upon review of *Futurecoast Aerial Photos (2002)* and OS maps. This shows no significant impact upon coastal processes.
Brit	346239	90494	Estuary has a very high flow volume causing a plume at almost all river flows and this in turn possibly causes local modification to littoral transport from one side of the harbour to the other (*Futurecoast, 2002*). Sluices control discharge into West Bay Harbour from the river (*SCOPAC Sediment Transport Study, 2004*). The harbour entrance structures inhibit longshore transport processes and the estuary as a whole is likely to be dynamically important to adjacent beaches (*Futurecoast, 2002*). Transport of shingle across the mouth occurs, as evidenced by periodic shingle accumulation in the harbour, and so the harbour entrance structures are not a complete barrier to longshore transport (*SCOPAC Sediment Transport Study, 2004*).
Bride	347813	89484	Not included explicitly in Futurecoast (2002), so analysis here is based upon review of *Futurecoast Aerial Photos (2002)* and OS maps. This shows a river discharging through a shingle ridge and over a shingle foreshore. From Halcrow's experience from developing a beach management plan for this beach it is known that the Environment Agency manage the entrance to control flood risk – this involves both closing and clearing the entrance of shingle to prevent tidal inundation or allow fluvial drainage as necessary.
Burton Mere	350957	87875	Not included explicitly in Futurecoast (2002), so analysis here is based upon review of *Futurecoast Aerial Photos (2002)* and OS maps. This shows an area of enclosed marsh land behind Chesil Beach. It has no obvious interaction with the coastal processes.
The Fleet	360456	82307	A number of small streams drain into the western end of the Fleet, providing freshwater input. The only direct interaction with the open sea is a small tidal inlet at Ferrybridge towards the Portland end of the Fleet (*Futurecoast, 2002*). There is at present no significant interaction on coastal processes, though at the Wyke Narrows the tidal flow is constrained and so high currents occur through this channel, which in turn stops the beach rolling back into the channel. Intrusion of saltwater through Chesil Beach into the Fleet

River/Lagoon	Tidal Limit OS Co-Ordinates		Interaction with Coastal Processes
	Easting	Northing	
			also occurs through both gradual seepage and (less frequent) 'bursts' (forming 'cans' on the Fleet side of Chesil Beach (*Malcolm Bray Lecture 21/11/07 and associated slides*). Whilst at present there are no direct interactions, The Fleet itself was formed as a result of enclosure by Chesil Beach (as a result of coastal processes), and should this breach in the future, then once again there will be more significant direct interactions with coastal processes (*Futurecoast, 2002*).
Wey	367730	79236	A series of sluice gates divide the mouth from the freshwater Radipole Lake upstream and also control the discharge rate (except at times of high river flows when they are opened to reduce flood risk upstream). As a result there is little fluvial sediment input to the coast. Some sediment enters the mouth from the sea and is deposited (*Futurecoast, 2002*).

Based upon the information summarised in Table 1, it is apparent that of the estuaries identified in the Scoping Report of June 2007, the estuaries that have a significant direct interaction with the sea are:

- **Brit Estuary (West Bay)** – inhibits longshore transport and discharge may affect sediment transport across the mouth;
- **Axe Estuary** – coastal processes have formed a spit across the mouth, though this can be breached during high river flow events;
- **Otter Estuary** – coastal processes have formed a spit across the mouth.
- **Exe Estuary** – complex sediment transport system involving double spits at the mouth and flood and ebb tidal deltas, the latter having an influence on coastal processes over a wide area;
- **Teign Estuary** – spit across the mouth as well as a very mobile ebb tidal delta, both of which form parts of a cyclic sediment transport system.

Given the size of both the Tamar and Dart estuaries, it is perhaps surprising that they are not included within the above list of estuaries that have a significant interaction with coastal processes. The reason for this is that, despite their size, neither contributes a large amount of sediment to the sea because of the hard, resistant geology through which their rivers flow.