

Marine biotope survey of the intertidal flats at the recharge proposal sites: Mersea Quarters and Tollesbury Wick

Report prepared for the Mersea Harbour
Protection Trust

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Introduction

An intertidal survey was carried out to determine the type of marine habitats (biotopes) present on the foreshore at each of the recharge proposal areas: Cobmarsh Island, Packing Marsh Island, Old Hall and Tollesbury Wick. The survey is intended to inform an assessment on the impact of the recharge placement on the foreshore. The intertidal mudflats and saltmarsh are features of the Essex Estuaries Special Area of Conservation (SAC), and supporting features of the Special Protection Area (SPA) for Wild Birds and Ramsar site. The survey was also intended to indicate the presence of 'intertidal mixed sediment' and the native oyster (*Ostrea edulis*), the reasons for the designation of the Blackwater, as an inclusive part of the Marine Conservation Zone.

The survey method is equivalent to that employed to monitor Special Areas of Conservation. The transects are relocatable and the survey can be repeated post recharge placement to assess change.

Field methodology

Prior to undertaking the fieldwork, a total of seven transects were mapped across the foreshore locations proposed for the deposition of recharge, using a GIS application, Global Mapper.

The surveys were carried out in August and September 2015 on spring tides, commencing approximately two hours before low water. With the exception of Tollesbury Wick, the sites were accessed by boat. The transects extended from the upper to the lower shore and included the recharge proposal area. A Trimble GeoExplorer 3000 XH Model with a Trimble Zephyr Antenna was used to collect the position and bearing of each transect and the sample locations. Positions were post processed in Trimble pathfinder office software to +/- 10cm. In order to facilitate sampling of the range of biotopes represented on the foreshore, distinct zones were differentiated along the transect based on changes in the nature of the surface substrate and evidence of invertebrate activity (eg presence of sand ripples, *Arenicola marina*, lugworm, casts). The boundary between each zone was then noted and a sample station was set up between the upper and lower limits of the demarcated areas. Where necessary, an additional sample was taken within the recharge footprint area to confirm the similarity with a definitive sample. As the sample stations were selected according to changes in surface conditions, the number of stations per transect varied. The sample stations and the foreshore extending approximately 50 metres either side of the sample points were photographed and described.

Sampling procedure

The density of conspicuous organisms (eg *Arenicola marina*, lugworm) was estimated by counting the number of casts/ m² on the surface. A dig was carried out – two spade loads to 20 cm depth – and infaunal specimens present were either determined in the field or preserved in 70% industrial denatured alcohol (IDA) for identification in the laboratory. Three replicate 0.01m² cores of 15cm depth were collected and combined at each sample station for sieving off site. A further core sample was extracted for particle size analysis (PSA). All samples obtained were clearly labelled in plastic containers and stored in cool conditions prior to transfer to the laboratory. Information on water content, depth of surface sediment and anoxic layer, presence of drainage channels, and localised erosion was also recorded.

Results

Benthic faunal analysis and particle size analysis were carried out by Thomson unicomarine and details of this are presented in their 2015 report. Invertebrates were identified to species level or family level and an abundance list was also produced. Thomson unicomarine were able to give an indication of the biotopes based on the fauna present and the PSA analysis. The current version of the biotope classification was used to make this assessment (Connor et al, 2004)

A description of the biotopes represented at each of the proposal sites was prepared from the benthic faunal analysis and field records. The transect/sample station descriptions are presented in the tables, figures and text below. Photographs taken during the fieldwork are supplied at the end of this report.

Cobmarsh Island

Table 1 describes the foreshore transects and these are illustrated in Figure 1.

Table 1. Cobmarsh Island - biotopes across foreshore transects from west to east (and core sample data)					
Transects (sampled from upper to lower shore)					
SS	Western transect (T3)	SS	Central transect (T1)	SS	Eastern transect (T2)
1	LS.LSa.MoSa.OI - Oligochaetes in littoral mobile sand. Individuals: 145; taxa: 7	Not sampled	LS.LSa.St.Tal - Talitrids (sandhoppers) on the upper shore and strandline	1	LS.LSa.St.Tal - Talitrids (sandhoppers) on the upper shore and strandline Individuals: 9; taxa: 1
2	LS.LMu.MEst.NhomMac Str - <i>Nephtys hombergii</i> , <i>Macoma balthica</i> and <i>Streblospio shrubsolii</i> in littoral sandy mud. Individuals: 260; taxa 20	1	LS.LSa.MoSa.OI - Oligochaetes in littoral mobile sand Individuals:155; taxa 8	2	LS.LSa – Littoral sand (Note: Thomson unicomarine, 2015, classified as ' LS.LMu - Littoral mud' however, the particle size analysis report allocates this to the textural group 'sandy gravel') Individuals: 6; taxa 2
3	LS.LMu.MEst.HedMacScr - <i>Hediste diversicolor</i> , <i>Macoma balthica</i> and <i>Scrobicularia plana</i> in littoral sandy mud Individuals: 124; taxa 5	2	LS.LMu.MEst.NhomMac Str - <i>Nephtys hombergii</i> , <i>Macoma balthica</i> and <i>Streblospio shrubsolii</i> in littoral sandy mud. Individuals: 2029; taxa 12	3	LS.LSa.MuSa - Polychaete/bivalve dominated muddy sand shores Individuals: 421; taxa 11

Table 1. Cobmarsh Island - biotopes across foreshore transects from west to east (and core sample data)					
Transects (sampled from upper to lower shore)					
SS	Western transect (T3)	SS	Central transect (T1)	SS	Eastern transect (T2)
		3	LS.LMu.MEst - Polychaete/bivalve-dominated mid estuarine mud shores /LR.FLR.Eph.BLitX - Barnacles and <i>Littorina</i> spp. (periwinkles) on unstable eulittoral mixed substrata Individuals: 553; taxa 17	4	LS.LMu.MEst.NhomMacStr - <i>Nephtys hombergii</i> (catworm), <i>Macoma balthica</i> (Baltic tellin) and <i>Streblospio shrubsolii</i> (polychaete worm) Individuals: 156; taxa 12
4	LS.LMu.MEst.HedMacSc r - <i>Hediste diversicolor</i> , <i>Macoma balthica</i> and <i>Scrobicularia plana</i> in littoral sandy mud Individuals: 156; taxa 10			5	LS.LBR.LMus.Myt.Sa - <i>Mytilus edulis</i> (blue mussel) beds on littoral sand Individuals: 930; taxa 20

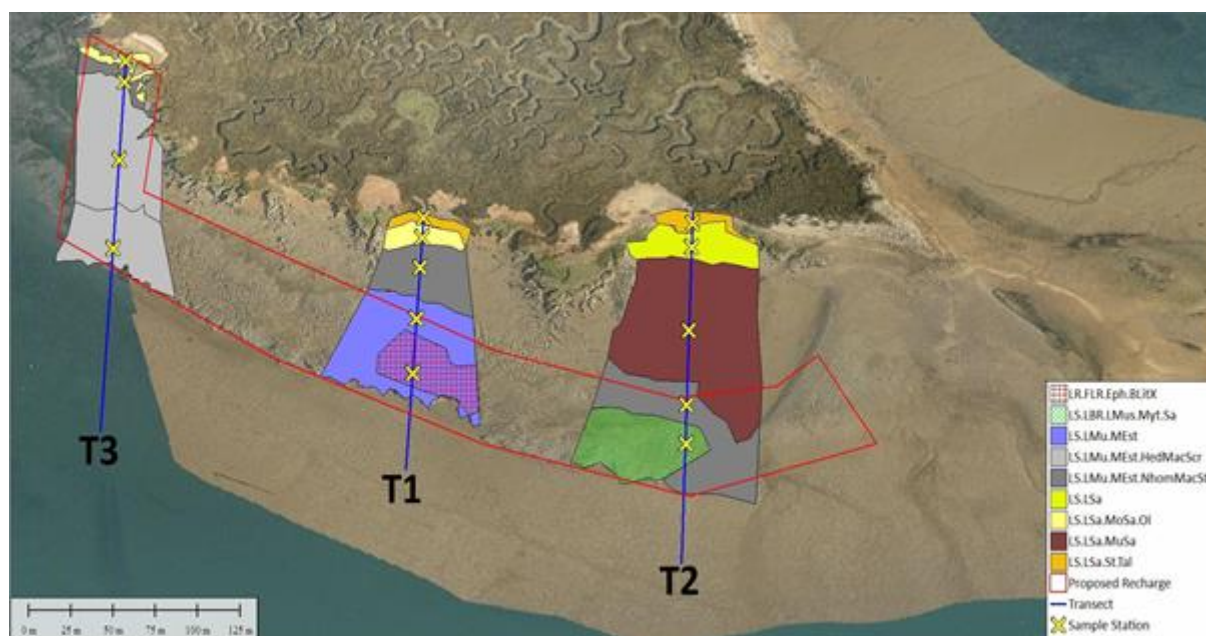


Figure 1. Cobmarsh Island – marine biotope distribution over proposed recharge area and upper shore.

Cobmarsh Island – Western foreshore transect (T3)

Sample station 1 - LS.LSa.MoSa.OI - Oligochaetes in littoral mobile sand

Coarse sands and gravel form a thick surface layer over black, soft consolidated silt/clay. The oligochaetes represented were *Baltidrilus costatus* and an Enchytraeid worm. Saltmarsh mounds lay either side of the sample station sparsely vegetated with glasswort (*Salicornia* sp) and annual sea-blite (*Suaeda maritima*) and vegetation on the foreshore included the green alga, *Ulva* sp, red algae; and bladderwrack (*Fucus vesiculosus*)

Sample station 2 - LS.LMu.MEst.NhomMacStr - *Nephtys hombergii*, *Macoma balthica* and *Streblospio shrubsolii* in littoral sandy mud

The most abundant species in the sample were the oligochaete sludge worms: *Tubificoides benedii* and *Tubificoides pseudogaster* (agg.), the dominance of these species is typical of this biotope. Other distinctive species were the catworm (*Nephtys hombergii*; only 1 specimen), the mud snail *Peringia ulvae*, and ragworm (Nereididae); the latter found in both the core sample and the dig.

Sample stations 3 & 4 - LS.LMu.MEst.HedMacScr - *Hediste diversicolor*, *Macoma balthica* and *Scrobicularia plana* in littoral sandy mud

Sample station 4 was located on a degraded saltmarsh platform, the margins of which mark the seaward edge of the marsh indicated on the 1888 Ordnance Survey map. The ratio of silt/clay to sand content at sample stations 3 and 4 was around 3 to 1. Both core samples contained ragworm (*Nereididae*) and the mud snail *Peringia ulvae*. The polychaete, *Pygospio elegans*, also common to this biotope, was only found in the sample at station 3. This station also included the sea slug *Alderia modesta*, a specialist herbivore feeding on *Vaucheria* sp (a yellow-green alga) and associated with the flood zone of saltmarshes.

Cobmarsh Island - Central foreshore transect (T1)

Sample station 1 - LS.LSa.MoSa.OI - Oligochaetes in littoral mobile sand

Particle size analysis shows a similar profile to the upper shore community identified in Cobmarsh transect 1, lying immediately west, consisting of coarse sand sparsely covered in pebbles. The sand was darker in colour to the recharge sand to the east and is likely to derive from a natural Chenier moved shoreward by extreme weather events. The biotope is characterised by enchytraeid oligochaete worms. The adjacent saltmarsh has suffered surface abrasion and large clay boulders eroded from the cliff edge are strewn across the beach. Chenier sands have been lifted by wave action onto the marsh; this ridge of beach material supports shrubby sea blite (*Suaeda vera*).

Sample station 2 - LS.LMu.MEst.NhomMacStr - *Nephtys hombergii*, *Macoma balthica* and *Streblospio shrubsolii* in littoral sandy mud

This is a continuation of the biotope identified in the transect to the west (T3); the percentage of constituent sands, silts and clay were found to be comparable. Fine to medium sands (3mm depth) formed the top layer of sediment over sticky, silty clay. Large clay boulders were distributed all around the sample area. To the west there were strips of severely eroded,

unvegetated marsh separated from the main body of the saltmarsh. This sample station was found to support species typical of the biotope with the catworm, *Nephtys hombergii* and 13 individuals of *Tubificoides benedii* - the oligochaete sludge worm. Adults and juveniles of the bivalve, *Macoma balthica*, were also present. Over 1900 marine snails were counted, mostly *Peringia ulvae*.

Sample station 3 (2 biotopes indicated) - LS.LMu.MEst - Polychaete/bivalve-dominated mid estuarine mud shores /LR.FLR.Eph.BLitX - Barnacles and *Littorina* spp. (periwinkles) on unstable eulittoral mixed substrata.

The dig exposed a 5cm anoxic layer below a thin sand layer. The substratum contained a much higher cohesive silt/clay fraction than the upper shore samples on this transect. The pebbly foreshore was carpeted with green algae (*Ulva intestinalis*) extending south and westward of the sample station. Lying to the east of the transect the surface was uneven with small mounds of clay interspersed with mud pools. A few waders were feeding along the water's edge in the shallow sublittoral zone. The marine community transitioned between two biotopes: the infauna of the marine worm/bivalve community included four species of worm, of which *Tubificoides benedii*, was the most numerous, and three species of bivalve - the oval cockle (*Parvicardium pinnulatum*), the Baltic tellin (*Macoma balthica*) and the clam, *Abra tenuis*. The pebbles provided a substrate for the invasive barnacle, *Austrominius modestus*, which is native to Australia and New Zealand. It was first recorded in the UK in Chichester Harbour in 1945 and has spread rapidly around the British coast since then, transported on ship hulls and through pelagic dispersal of larvae (GB Non-native Species Secretariat, 2012). Chitons and the periwinkle, *Littorina saxatilis*, which graze on algae on the rocky surface, were also a feature. This sheltered environment supported various crustaceans, including juvenile shore crabs (*Carcinus maenas*). The mud snail (or Laver spire shell) I, *Peringia ulvae* was well represented.

Cobmarsh Island - Eastern foreshore transect (T2)

Sample station 1 - LS.LSa.St.Tal - Talitrids (sandhoppers) on the upper shore and strandline

No core sample was taken. The sample station was located in the driftline just below a belt of shrubby sea-blite (*Suaeda vera*) which has colonised the sand and gravel. Sandhopper burrows were evident on the surface sands. Along with gravel, and shell fragments, the sand has probably been washed from the recharge which has been moved by wave action around the south-eastern point of the island. Nine specimens of the talitrid amphipod *Macarorchestia roffensis* (sandhopper) were isolated from the dig sample.

Sample station 2 - LS.LSa - Littoral sand - (Note: Thomson unicomarine, 2015, classified the sample as 'LS.LMu - Littoral mud' however, particle size analysis allocates this sample to the textural group 'sandy gravel').

The core sample recorded very low numbers of the Laver spire shell (*Peringia ulvae*) and nematode (round) worms. Poorly sorted coarse to medium sands and gravel, which characterised the sample, are likely to have migrated westward from the recharge. The sample station was situated between saltmarsh abrasion platforms which support *Spartina anglica* (common cord-grass). Stiff clays were encountered in the dig.

Sample station 3 - LS.LSa.MuSa - Polychaete/bivalve dominated muddy sand shores.

The muddy sand surface was underlain by water-saturated silts at 100mm depth. Eighteen individual worm casts of *Arenicola marina* (lugworm) were counted within 1m² on the surface and four were found in the dig sample, along with a juvenile shore crab (*Carcinus maenus*). The core samples revealed the presence of other species of polychaete worms; the marine snails *Peringia ulvae* and *Retusa obtusa* (Arctic barrel bubble snail); and the clam *Abra tenuis*.

The sample location supported the green alga, *Ulva intestinalis*. *Ascophyllum nodosum* (knotted wrack) and *Fucus vesiculosus* (bladderwrack) had colonised part of the old Nass beacon washed up on the foreshore nearby. In the lee of the beacon the sands appeared stable; otherwise the sands were mobile with wave action forming a ripple pattern on the surface.

Sample station 4 - LS.LMu.MEst.NhomMacStr - *Nephtys hombergii* (catworm), *Macoma balthica* (Baltic tellin) and *Streblospio shrubsolii* (polychaete worm) in littoral sandy mud

The low shore had by a thin covering of fine sands (3mm) over soft, sticky clay. Sea water lay in surface depressions. Only one specimen of *Streblospio shrubsolii*, normally expected to be dominant in this biotope, was found. However, the spire shell *Peringia ulvae*, also a characterising species of the biotope, was present and the most abundant organism in the sample.

Sample station 5 - LS.LBR.LMus.Myt.Sa - *Mytilus edulis* (blue mussel) beds on littoral sand

Pebbles covered in the invasive barnacle, *Austrominius modestus*, were widespread over the lower shore. Mussels were found in both the dig and core samples (1 individual in each). Various amphipod crustaceans and chitons were also present. This distinctive community extended in a band westwards over the low intertidal. *Ulva intestinalis* (green alga) blanketed the pebbles, in places, and there were occasional clumps of *Fucus vesiculosus* (bladderwrack), *Ascophyllum nodosum* (knotted wrack), and red seaweeds. To the east clay boulders were scattered across the surface and, to the south-west, above this zone, there were remnant saltmarsh platforms.

Packing Marsh Island – single transect

The biotope for this transect is indicated in Table 2 and Figure 2.

Table 2. Packing Marsh biotopes on central transect (and core sample data).	
SS	Biotope
1	LS. LSa.St.Tal - Talitrids on the upper shore and strandline Individuals: 6; taxa 2
2	LS. LSa.St.Tal - Talitrids on the upper shore and strandline

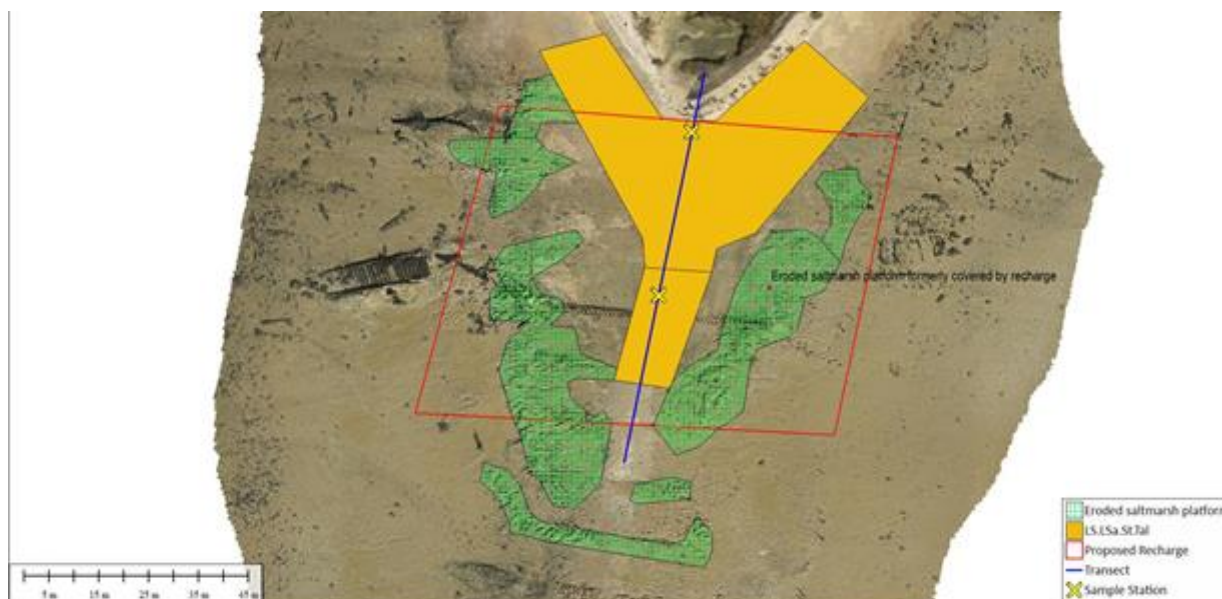


Figure 2. Packing Marsh Island – biotope and habitat description within the proposed recharge footprint.

Sample station 1 - LS. LSa.St.Tal - Talitrids on the upper shore and strandline

Recharge sands and gravels deposited in 1998 have transgressed landward. Above mean high water springs the crest of the recharge has become colonised with shrubby sea-blite *Suaeda vera* and *Atriplex littoralis* (linear-leaved orache). Below the shallow slopes of the ridge and either side of the transect the abraded saltmarsh platform had a cover of *Ulva intestinalis*. Amphipod burrows were evident in the finer sands and a dig sample exposed the talitrid amphipod (sandhopper) *Macarorchestia roffensis*. Core samples were not collected for at this station as the biotope was assigned in the field.

Sample station 2 - LS. LSa.St.Tal - Talitrids on the upper shore and strandline

The particle size analysis described coarse to fine gravels and medium to coarse sands and these derive from the recharge. There was also a small percentage of medium to fine silts in the sample. Talitrid amphipods were evident upon digging. *Ulva intestinalis* (green alga) had colonised the low central ridge of the recharge which runs north to south. Below the ridge there were patches of *Ascophyllum nodosum* (knotted wrack) on the gravel. *Salicornia* sp had an 'occasional' distribution on the lower slopes.

Bed clays of the former saltmarsh are exposed seaward of the recharge ridge.

Old Hall south foreshore

Refer to Table 3 and Figure 3 for biotope descriptions and distribution.

Table 3. Old Hall - biotopes across foreshore transects from west to east (and core sample data)			
Transects			
SS	Western transect (T2)	S S	Eastern transect (T1)
1	LS.LMu - Littoral mud Individuals: 34; taxa 6	1	LS.LMu.UEst.Tben - <i>Tubificoides benedii</i> (sludge worm) and other oligochaetes in littoral mud Individuals: 15; taxa 5
2	LS.LMu.MEst.NhomMacStr - <i>Nephtys hombergii</i> , <i>Macoma balthica</i> and <i>Streblospio shrubsolii</i> in littoral sandy mud Individuals: 132; taxa 16	2	LS.LMu. - Littoral mud Individual: 1; taxon 1
3	LS.LMu.MEst.NhomMacStr - <i>Nephtys hombergii</i> , <i>Macoma balthica</i> and <i>Streblospio shrubsolii</i> in littoral sandy mud Individuals: 502; taxa 14	3	LS.LMu. - Littoral mud Individuals: 4; taxa 2
Not sampled	LS.LMu.MEst.HedMacScr - <i>Hediste diversicolor</i> , <i>Macoma balthica</i> and <i>Scrobicularia plana</i> in littoral sandy mud (assigned on basis of similarity to lower shore Sample 5)	4	LS.LMu.UEst.Hed.Str - <i>Hediste diversicolor</i> and <i>Streblospio shrubsolii</i> in littoral sandy mud Individuals: 138; taxa 14
5	LS.LMu.MEst.HedMacScr - <i>Hediste diversicolor</i> , <i>Macoma balthica</i> and <i>Scrobicularia plana</i> in littoral sandy mud Individuals: 213; taxa 21		

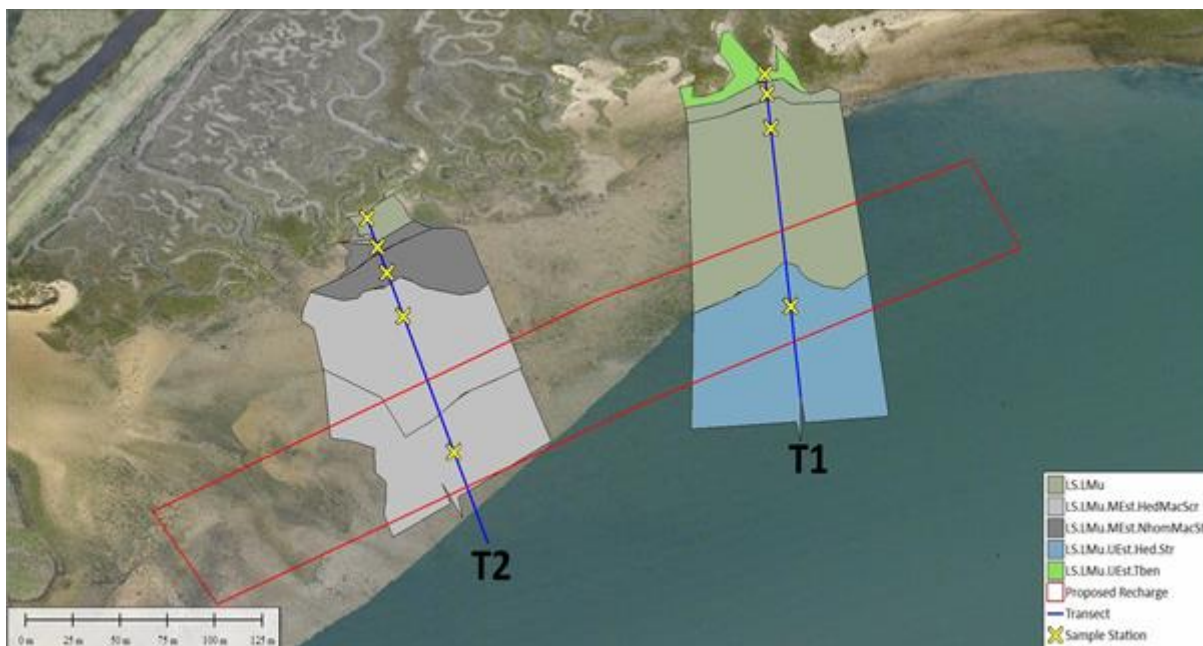


Figure 3. Old Hall south – marine biotope distribution over proposed recharge area and upper shore.

Old Hall western transect (T2)

Sample station 1 - LS.LMu - Littoral mud

Textural analysis categorised the sample as ‘gravelly muddy sand’ (Thomson unicomarine, 2015). Medium to coarse sands (of 100mm depth) may have been mobilised from the recharge placed to the west of this sample station in 1998. One individual of the tube dwelling polychaete *Spiophanes bombyx* was found, a species which has a preference for clean sands. Sand burrowing worms of the family Opheliidae were also present. The mud snail *Peringia ulvae* was the most abundant species.

Sample station 2 - LS.LMu.MEst.NhomMacStr - *Nephtys hombergii*, *Macoma balthica* and *Streblospio shrubsolii* in littoral sandy mud

This mid-shore sample location may also have received sands swept from the recharge. Medium to fine sands made up the greatest proportion of the sediment sample with a 6mm deep layer distributed over the surface forming a ripple pattern. Sticky silts made up the rest of the core profile. Polychaetes, oligochaetes and bivalves were features of the biotope with individuals of the catworm (*Nephtys* sp) and ragworm (*Nereididae*), present. Other polychaetes, from the Cirratulidae and Ampharetidae families had a greater representation in the sample. Nine individuals of the Baltic tellin (*Macoma balthica*) were identified, plus the marine snails, *Retusa obtusa* (Arctic barrel bubble snail) and *Peringia ulvae*, and small crustaceans. There was an occasional distribution of *Ulva lactuca* (sea lettuce), *Ulva intestinalis* (green alga) and *Fucus vesiculosus* (bladderwrack).

Sample station 3 - LS.LMu.MEst.NhomMacStr - *Nephtys hombergii*, *Macoma balthica* and *Streblospio shrubsolii* in littoral sandy mud

Mobile sands were underlain by black sticky silt/clay, with sea water 12mm below the surface. The sample returned 7 species of polychaete including juvenile *Nephtys* sp, but the most numerous marine worm was the oligochaete sludge worm *Tubificoides benedii*. *Macoma balthica* (Baltic tellin) were also extracted from the sample along with one cockle (family: Cardiidae). *Ulva lactuca* (sea lettuce), *Ulva intestinalis* (green alga) and *Fucus vesiculosus*, bladderwrack were present on the tidal flats. The mud snail *Peringia ulvae* was abundant. Bird tracks were evident on the surface.

Sample station 4 - LS.LMu.MEst.HedMacScr - *Hediste diversicolor*, *Macoma balthica* and *Scrobicularia plana* in littoral sandy mud – no sample analysed as field observation determined the surface and subsurface sediment was comparable with sample station 5 located on the lower shore earmarked to receive recharge (see below).

Sample station 5 - LS.LMu.MEst.HedMacScr - *Hediste diversicolor*, *Macoma balthica* and *Scrobicularia plana* in littoral sandy mud (**Note:** Thomson unicomarine's report, 2015, labels this sample as Transect 1, and this should be Transect 2).

A thin veil of fine sands (4mm depth) covered the surface above a silt/clay substratum. *Hediste diversicolor* (ragworm) were present as adults and juveniles along with *Phyllodoce mucosa* (paddle worm). The tube-living *Pygospio elegans* was the dominant polychaete, at 50 individuals, with single figure numbers of the oligochaete sludge worm *Tubificoides benedii*. The combined total of Spionid and Cirratulid polychaetes was just below 20. Low numbers of the mud snail *Peringia ulvae* were counted, and head shield/bubble snails (Cephalaspidea) were also part of the assemblage. Only one specimen of *Macoma balthica* was present with two juvenile cockles (Cardiidae). The lower foreshore was badly eroded and its low, smoothed mud mounds are remnants of former saltmarsh. Sea bird tracks were observed in the area.

Old Hall eastern transect (T1)

Sample station 1 - LS.LMu.UEst.Tben - *Tubificoides benedii* (sludge worm) and other oligochaetes in littoral mud

An anoxic layer over 20cm deep was present below coarse sands and gravel of 10cm depth. The subsurface sediment was extracted as a solid plug of black silty clay which, on analysis, was predominantly comprised of coarse silts. The biotope assigned to this upper shore sample station is reflective of the poor infauna. The shingle material is likely to have derived from the 1998 recharge placed at Old Hall point. The mobility of the recharge westward and shoreward, combined with fresh and sea water drainage through this section from the saltmarsh creeks, may account for the presence of opportunistic species such as the Cirratulid polychaete worm and *Capitella* sp (polychaete worm) which are tolerant of environmental disturbance. Sand burrowing Opheliids were the most numerous polychaete worms in the sample.

Finer well-sorted recharge sands to the east of this transect, around Old Hall Point supported an occasional distribution of *Arenicola marina* (lugworm) and the sand mason worm, *Janice conchilega*, indicating some degree of stability.

Sample station 2 - LS.LMu. - Littoral mud

This sample also contained a 20cm deep anoxic layer below sparsely distributed gravel on the foreshore. Water run-off from the saltmarsh creeks had washed off the surface material as there was a greater coverage of sand and pebbles either side of the sample station. Coarse silts and clay defined this sample. Only the mud snail, *Peringia ulvae* was recorded. Eroding saltmarsh lies alongside the transect at this point. On the NW side of the sample station, clay boulders eroded from the cliff face of the saltmarsh littered the foreshore.

Sample station 3 - LS.LMu. - Littoral mud

Mud to a depth of 2mm was measured on the surface. Coarse to medium silts and clay were the main elements in the particle sample. A juvenile shore crab *Carcinus maenas* and marine snails were found in the sample. Runnels draining the saltmarsh are a feature of the foreshore in this transect. Green algae have collected on the clay mounds on the flats. Red algae and *Fucus vesiculosus* (bladderwrack) were also noted.

Sample station 4 - LS.LMu.UEst.Hed.Str - *Hediste diversicolor* and *Streblospio shrubsolii* in littoral sandy mud

Sand formed a 2mm layer on the surface, while the cohesive sub-stratum contained a high percentage of silt/clay. Species tolerant of reduced salinity were among the most abundant species, including the polychaete worms: *Streblospio* sp, ragworms (Nereididae), *Pygospio elegans*, *Melinna palmate*, *Tharyx* sp, and small crustaceans. The green alga, *Ulva intestinalis*, sea lettuce (*Ulva lactuca*), and bladderwrack (*Fucus vesiculosus*) were frequently distributed over the intertidal flats. The shallow depressions in the surrounding mud flats held sea water.

Tollesbury Wick – single transect

The biotopes are listed in Table 4 and mapped in Figure 4.

Table 4. Tollesbury Wick biotopes on single transect	
SS	Biotope
1	LS.LMu.UEst.Hed.OI - <i>Hediste diversicolor</i> and oligochaetes in littoral mud Individuals: 104; taxa 15
2	LS.LMu.MEst.NhomMacStr - <i>Nephtys hombergii</i> , <i>Macoma balthica</i> and <i>Streblospio shrubsolii</i> in littoral sandy mud Individuals: 167; taxa 11
Not sampled	LS.LMu.MEst.NhomMacStr - <i>Nephtys hombergii</i> , <i>Macoma balthica</i> and <i>Streblospio shrubsolii</i> in littoral sandy mud

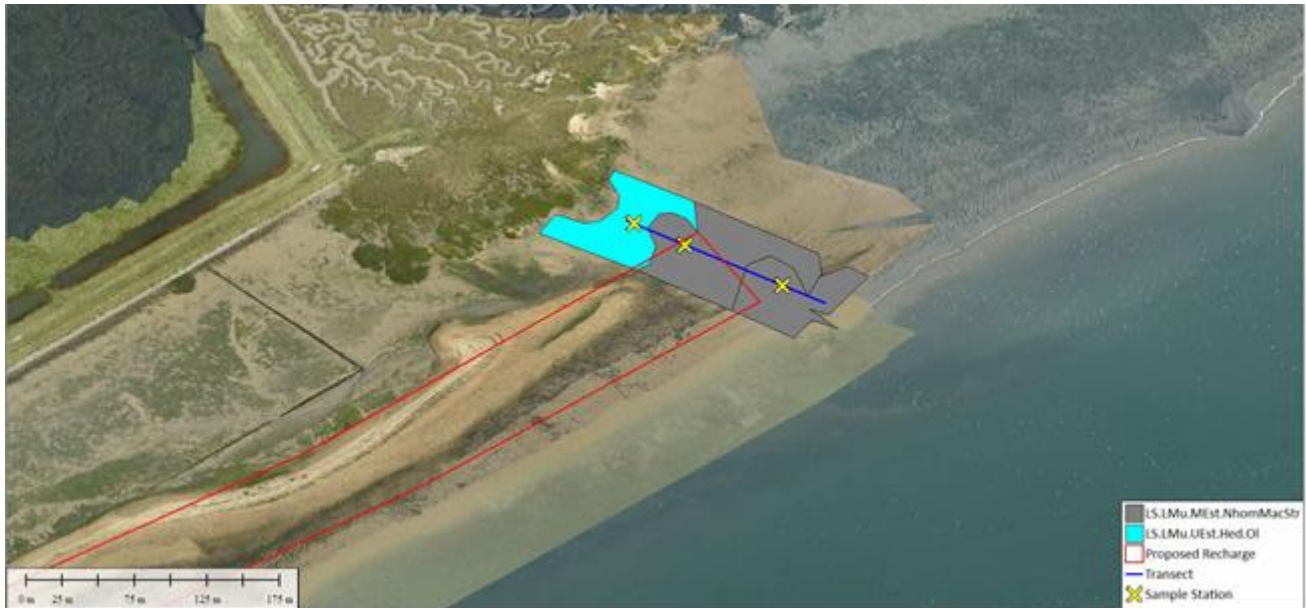


Figure 4. Tollesbury Wick - marine biotope distribution over proposed new recharge area and upper shore.

Sample station 1 - LS.LMu.UEst.Hed.OI - *Hediste diversicolor* and oligochaetes in littoral mud

This sample station receives some protection from the north-eastern extent of the recharge placed in 1999 and there was a light settlement of silts. Particle size analysis assigned a description of sandy muds constituting very fine sands and predominantly fine to coarse silts with a small amount of clay.

To the north-east of the transect the foreshore was very exposed and the saltmarsh edge was eroding with the abraded marsh reduced to unvegetated mud mounds on the clay flats. To the west the intertidal was similar except water is retained on the lower shore, just inside the north-eastern edge of the recharge bund.

A range of species were present including those typically described for the biotope – ragworm identified to family level (Nereididae), and, specifically, *Hediste diversicolor*; the spionid worm *Polydora cornuta* (juvenile), the oligochaetes, *Tubificoides benedii* (sludge worm) and an Enchytraeid worm; and species associated with a more diverse biotope dominated by *Hediste diversicolor* and the bivalve *Macoma balthica*: *Pygospio elegans* (polychaete) and the clam *Abra tenuis*. The cohesive sandy muds at this location also supported the polychaete *Melinna palmate* and a tube-dwelling polychaete of the family Ampharetidae. Both adults and juvenile mud snails *Peringia ulvae* were recorded.

Sample station 2 - LS.LMu.MEst.NhomMacStr - *Nephtys hombergii*, *Macoma balthica* and *Streblospio shrubsolii* in littoral sandy mud

The sample station was located on the fine sand washed from the north-eastern extent of the recharge bund. Short-term lagoons form in this area and the sample site was filling with water during digging. Below the 5mm covering of fine sand, there was a layer of friable, wet, black silt with coarser sand, and below this soft blue/grey silty clay. Black sea weed, red algae and

the green alga *Ulva intestinalis* lay on the surface inside and outside of the sand bund, with a sparse cover of pebbles and shell.

This mid-shore sample found 7 lug worm *Arenicola marina* and 2 juvenile shore crabs (*Carcinus maenus*) in the dig, and juvenile *Nephtys hombergii* (catworm), *Tubificoides benedii* (sludge worm), Cirratulid polychaetes, *Arenicola marina*, and juvenile bivalves, in the core sample.

Lower shore, below Sample Station 2

LS.LMu.MEst.NhomMacStr - *Nephtys hombergii*, *Macoma balthica* and *Streblospio shrubsolii* in littoral sandy mud appeared to extend below the sands from the recharge bund.

Distribution of biotopes over the foreshore

Aerials, field notes and photographs have been used to try and indicate the spatial extent of the biotopes over the foreshore, based on the biotopes assigned at each sample site. Although this cannot be accurately represented, due to the subjective nature of defining boundaries between sediment biotopes, it provides a reasonable guide to the distribution of the marine communities present within the proposal area.

Summary of findings – across all sites

The sediment composition of the study areas generally consisted of ‘sandy mud’ (Thomson unicomarine, 2015, Appendix 6b). Across the survey area, at all sites, the distribution pattern of the biotopes was similar, with species-poor communities in the upper shore and polychaete and bivalve dominated communities in the mid to lower shore. At Cobmarsh Island the lower shore between the central and eastern transects was covered in pebbles, supporting barnacles and periwinkles, with evidence of blue mussel.

Organisms represented in the samples were typical of estuarine mudflats with variable diversity and abundance. The number of taxa in the core samples ranged from 0 to 20, with between 0 and 2029 individuals. The most abundant species was the marine snail *Peringia ulvae* with the non-native barnacle, *Austrominius modestus*, the second most numerous.

Individual site summaries

Cobmarsh Island

The strandline at Cobmarsh was characterised by Talitrids (sandhoppers) and below this, across the transects, a species-poor community of oligochaete worms occurred (LS.LSa.MoSa.OI) on this exposed upper shore. The sands supporting this community are derived from a natural Chenier beach. Wave energy in this area is causing considerable damage to saltmarsh and the adjacent foreshore is covered with lumps of clay cleaved from the saltmarsh cliff. On the mid to lower shore fine to medium sands cover silty clay and supported an often low population of marine worms, with marine snails and bivalves in greater abundance. This community was assigned to the biotope LS.LMu.MEst.NhomMacStr. The low shore, at the western end of the study area supported reasonable numbers of polychaete worms, including ragworms (Nereididae), and the sea slug, *Alderia modesta* associated with the flood zone of saltmarshes (LS.LMu.MEst.HedMacScr). To the east, the littoral muds, dominated by marine worms and bivalves, transition into the lower eu littoral zone where

pebbles and cobbles, colonised by the invasive barnacle, *Austrominius modestus*, and periwinkles (*Littorina saxatilis*), overlies the flats (LR.FLR.Eph.BLitX). There is evidence of blue mussel beds, *Mytilus edulis* (LS.LBR.LMus.Myt.Sa) associated with this community.

Packing Marsh Island

The recharge proposal here is to place onto existing recharge which supported the strandline community LS. LSA.St.Tal. Abraded platforms of former saltmarsh lie on the perimeter of the transect.

Old Hall

The eastern upper shore area was characterised by anoxic silty clay, covered by coarse sands and gravel likely to have been mobilised westwards from the recharge. The infauna in this community, LS.LMu.UEst.Tben, is poor and likely to be influenced by the salt/freshwater drainage from a saltmarsh creek. Samples obtained below this were extremely poor and anoxic.

The mid-shore at Old Hall supported the biotope LS.LMu.MEst.NhomMacStr where sands likely to have been swept from the recharge cover the sticky silt/clays. A variety of oligochaete and polychaete worms were represented along with marine snails and bivalves. Further down the shore, where ragworm (Nereididae) were found in the sample, the biotope LS.LMu.UEst.Hed.Str was described, and, where bivalves were present on the more exposed foreshore to the west, LS.LMu.MEst.HedMacScr was assigned.

Tollesbury Wick

The upper shore is ascribed the biotope LS.LMu.UEst.Hed.OI with ragworm (Nereididae) and the oligochaete sludge worm. Species abundance was low, with marine snails making up the largest population. The mid-shore sample contained polychaete worms and bivalves associated with LS.LMu.MEst.NhomMacStr.

References

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Thomson unicomarine (2015). Mersea Quarters Benthic Faunal Analysis and Particle Size Analysis Report for Mersea Harbour Protection Trust. Authors: Charlotte Newberry and Sajan Sebastian.

Photographs of transects and sample stations

Cobmarsh Island

Western foreshore transect (T3) – Figures 1- 18



Figure 1. Start of transect on Chenier beach.



Figure 2. SS1 shows surface & subsurface material.



Figure 3. SS1 surface.



Figure 4. SS1 view north-east.



Figure 5. SS1 view west.



Figure 6. SS2 indicates surface & subsurface sediments.

Cobmarsh Island - Western foreshore transect (T3) – Figures 1- 18 (cont.)



Figure 7. SS2 photo 2.



Figure 8. SS2 view east.



Figure 9. SS2 view west.



Figure 10. SS3.



Figure 11. SS3 view east.



Figure 12. SS3 view west.

Cobmarsh Island - Western foreshore transect (T3) – Figures 1 - 18 (cont.)



Figure 13. SS3 view shoreward along transect.



Figure 14. SS3 view upper shore along transect.



Figure 15. SS4.



Figure 16. SS4 view east.



Figure 17. SS4 view west.



Figure 18. View of western transect (T3) from lower shore.

Cobmarsh Island - Central foreshore transect (T1) Figures 19 to 30



Figure 19. Transect line view from upper to lower shore.



Figure 20. SS1.



Figure 21. SS1 view east.



Figure 22. SS1 view west.



Figure 23. SS2.



Figure 24. SS2 view east.

Cobmarsh Island - Central foreshore transect (T1) Figures 19 to 30 (cont.)



Figure 25. SS2 view west.



Figure 26. SS3.



Figure 27. SS3 dig shows substrate profile



Figure 28. SS3 view north-west.



Figure 29. SS3 view east.



Figure 30. View landward along central (T1) transect line.

Cobmarsh Island - Eastern foreshore transect (T2) – Figures 31 – 52



Figure 31. View south along transect line.



Figure 32. SS1 - strandline.



Figure 33. SS1 view east along strand line.



Figure 34. SS1 view west along strandline.



Figure 35. SS2.



Figure 36. SS2 view east.

Cobmarsh Island - Eastern foreshore transect (T2) Figures 31 to 52 (cont.)



Figure 37. SS2 view west



Figure 38. SS3.



Figure 39. SS3 – lugworm from dig.



Figure 40. SS3 is on the edge of mobile sands.



Figure 41. SS3 view east.



Figure 42. SS3 view west.

Cobmarsh Island - Eastern foreshore transect (T2) Figures 31 to 52 (cont.)



Figure 43. SS4.



Figure 44. SS4 core extraction holes show substrate type.



Figure 45. SS4 view south-east.



Figure 46. SS4 view west.

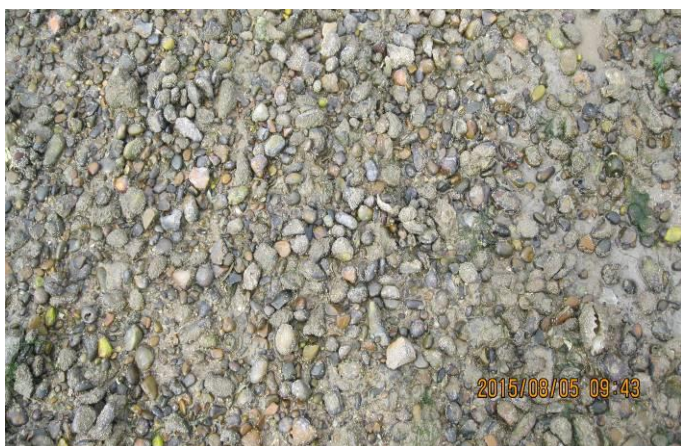


Figure 47. SS5.



Figure 48. SS5 indicates subsurface substrate.

Cobmarsh Island - Eastern foreshore transect (T2) Figures 31 to 52 (cont.)



Figure 49. SS5 view west.



Figure 50. SS5 view south-east.



Figure 51. View shoreward along transect (T2).



Figure 52. Degrading marsh west of transect (T2).

Packing Marsh Island – Transect and sample station photos



Figure 1. Transect view south.



Figure 2. Packing Marsh north end of transect.



Figure 3. SS1.



Figure 4. SS2.



Figure 4. SS2.



Figure 5. SS2 view east.

Packing Marsh Island – Transect and sample station photos (cont)



Figure 6. SS2 view east. Photo 2.



Figure 7. SS2 view west.



Figure 8. Transect

Old Hall – transect and sample station photos

Old Hall - Western transect (T2) Figures 1 to 22



Figure 1. View south along western (T2) transect line.



Figure 2. SS1.



Figure 3. SS1 view west.



Figure 4. SS1 view east.



Figure 5. Adjacent T2 indicates height of saltmarsh cliff.



Figure 6. Adjacent T2 – saltmarsh cliff.

Old Hall - Western transect (T2) Figures 1 to 22 (cont.)



Figure 7. Shrinkage and swelling has formed boulders in clay cliff.



Figure 8. Clay 'pebbles' on foreshore, sloughed from cliff.



Figure 9. SS1 – adjacent saltmarsh pool.



Figure 10. SS2.



Figure 11. SS2 dig shows subsurface sediment.



Figure 12. SS2 cores show subsurface sediment.

Old Hall - Western transect (T2) Figures 1 to 22 (cont.)



Figure 13. SS2 view east.



Figure 14. SS2 view west.



Figure 15. SS3.



Figure 16. SS3 view west – mobile sands.



Figure 17. SS3 view east.



Figure 18. SS3 view NE along transect line.

Old Hall - Western transect (T2) Figures 1 to 22 (cont.)



Figure 19. SS5 (SS4 not used as same community type).



Figure 20. SS5 view west.



Figure 21. SS5 view east.



Figure 22. Western transect (T2) view NW from lower shore.

Old Hall - Eastern transect (T1) – Figures 23 to 39



Figure 23. Eastern transect (T1) view south.



Figure 24. Sample station 1(SS1) dig shows subsurface.



Figure 25. SS1 view to west.



Figure 26. SS1 drainage channel to east.



Figure 27. SS2.



Figure 28. SS2 view west.

Old Hall - Eastern transect (T1) – Figures 23 to 39 (cont.)



Figure 29. SS2 view east.



Figure 30. SS2 – view shoreward of transect line.



Figure 31. SS3.



Figure 32. SS3 shows surface and subsurface sediment.



Figure 33. SS3 view west.



Figure 34. SS3 view east.

Old Hall - Eastern transect (T1) – Figures 23 to 39 (cont.)



Figure 35. SS4.



Figure 36. SS4. .



Figure 37. SS4 view shoreward.



Figure 38. SS4 view east.



Figure 39. SS4 view west.

Tollesbury Wick Transect 1 – transect and sample station photos and adjacent foreshore



Figure 1. Natural Chenier beach rollover NW of transect.



Figure 2. West of Chenier beach – saltmarsh building behind recharge (1999) bund.



Figure 3. SS1 view east (seaward).



Figure 4. SS1.



Figure 5. SS1 shows substrate.



Figure 6. SS1 view NE.

Tollesbury Wick Transect 1 – transect and sample station photos and adjacent foreshore (cont.)



Figure 7. SS1 to west inside NE end of recharge bund.



Figure 8. SS2 lugworm casts on surface.



Figure 9. SS2 view NE.



Figure 10. Inside recharge spur at NE end of 1999 recharge bund.



Figure 11. SS2 – dig reveals water just below surface.



Figure 12. Transect looking shoreward.