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Biotopes of the Intertidal and Subtidal Sediments around the AMEP site, in the Humber Estuary

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Institute of Estuarine and Coastal Studies

Biotopes of the Intertidal and Subtidal Sediments around the AMEP site, in the Humber Estuary

Final Report to Able UK Ltd

Institute of Estuarine and Coastal Studies
University of Hull

27th April 2012

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Reference No: SBB346-F-2012

For and on behalf of the Institute of Estuarine and Coastal Studies	
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Date:	27th April 2012

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1. BACKGROUND

1.1 Methods Overview

Sediment samples were taken by the Institute of Estuarine & Coastal Studies (IECS) from the subtidal and intertidal environment in the vicinity of the AMEP development site on the Humber Estuary during the spring/summer of 2010.

These samples were taken on behalf of Yorkshire Forward with the sampling programme aimed at broadly characterising the baseline physical and biological components of the estuary bed in the vicinity of the proposed development (including the approaches), the data also then being used to assist the EIA process.

A total of 30 subtidal grab samples and 36 intertidal cores (from 12 transects with samples from the upper, middle and low shore) were taken under the programme. These samples were then analysed both for particle size distribution and invertebrate community composition.

1.2 Environmental Context

The area from where the samples were taken features predominantly industrialised terrestrial margin with considerable ports related activity, and with port activity undertaken in areas of the intertidal and subtidal habitats e.g. jetties and quays.

The reach is characterised by a relatively narrow (in the context of the middle to outer estuary) intertidal area, the mudflat mostly ranging from c. 150m to 400m in width. The intertidal zone is backed by a hard flood defence wall, with the seaward toe featuring a variable cobble and fucoid cover. The main intertidal area is formed primarily of a soft sediment (mud), but with occasional cobble and boulders present.

The subtidal habitat in this area is primarily within the main southern channel of the estuary, this channel also forming part of the main navigation in this area of the estuary. As such, the subtidal habitat in this area of the estuary is both subject to relatively high energy influences, but also an active maintenance dredging campaign, both of which have considerable influence on the sediment characteristics and associated infauna of the area.

2. BIOTOPE ASSESSMENT

Based upon the information derived from the sediment sampling programme as described in Section 1, it has been possible to determine biotopes for the study area.

2.1 Intertidal Biotopes

The following Tables (Tables 1a-c) provide a summary of the specie assemblage present from the intertidal sampling stations from the upper, middle and lower shore. These data indicate that in general, the intertidal zone is broadly characteristic of the middle estuary in terms of species present, although it is emphasised that the sample volume from the study was based on only single replicates and might therefore be subject to some wider variability.

Table 1a. Intertidal Species Assemblage per Station and Biotope – Upper Shore

Yorkshire Forward intertidal 2010 (0.5mm sieve mesh) - Upper Shore															
MCS code		Taxon	Taxon qualifier	1 Upper	2 Upper	3 Upper	4 Upper	5 Upper	6 Upper	7 Upper	8 Upper	9 Upper	10 Upper	11 Upper	12 Upper
F		Microturbellaria						1							
HD	1	NEMATODA		1		12	3	2		2	2	6		20	3
P	117/118	Eteone flava/ longa													
P	462	*Hediste diversicolor*		12		26		5			24	4		13	30
P	494	*Nephtys*	juvenile												
P	672	*Scoloplos armiger*													
P	776	*Pygospio elegans*						1							
P	799	*Streblospio shrubsolii*		6	1	6	2	3	4	12			6	9	1
P	-	*Tharyx*	sp. "A"												
P	906	*Capitella*	sp. Complex												
P	929	*Arenicola*	juvenile												
P	1294	*Manayunkia aestuarina*		1		32		2		1				5	1
P	1420	*Paranais litoralis*				5	9	6		5					
P	1479	*Heterochaeta costata*			2			1			1			3	
P	1490	*Tubificoides benedi*		38	2	43	55	38	50	30	6	1		5	
P	1500	*Tubificoides swirenocoides*													
P	1501	*Enchytraeidae*												2	1
S	616	*Corophium volutator*			3	2	12		1	10	13	52		3	13
S	1253	*Diastylis rathkei*													
W	385	*Hydrobia ulvae*		4	1										
W	1695	*Mytilus edulis*	juvenile												
W	2007	TELLINACEA	juvenile	13					2						
W	2029	*Macoma balthica*		2	1		1			3	1	2	3	1	
W	2064	*Abra tenuis*		3											
Total Abundance				80	10	126	82	58	57	63	47	65	9	61	49
Quantitative Species Diversity				9	6	7	6	8	4	7	6	5	2	9	6
Qualitative Species Diversity				0	0	0	0	0	0	0	0	0	0	0	0
Total Species Diversity				**9**	**6**	**7**	**6**	**8**	**4**	**7**	**6**	**5**	**2**	**9**	**6**
				LS.LMu.MEst.HedMac											

Table 1a indicates a muddy substratum characterised by a small number of species, with *Tubificoides benedii* most abundant but with *Hediste diversicolor* and *Corophium volutator*, both important prey items for wader species. Other species of polychaete are also present,

together with small numbers of the bivalve *Macoma balthica*, these also forming an important component of the diet of a number of species of waterbird. Based on these data, the biotope LS.LMu.MEst.HedMac has been assigned. This is a biotope characteristic of middle to outer estuaries and has been recorded from both shores of the Humber (e.g. ABPmer, 2010; Elliott *et al*., 2008).

Table 1b similarly indicates a muddy substratum characterised by a small number of species, with *Tubificoides benedii* and *Corophium volutator* most abundant. However, *Hediste diversicolor* is absent from the assemblage, this being an important waterbird prey item, although several other species of polychaete are present, together with small numbers of the bivalve *Macoma balthica*, these being taken in the diet of a number of wader species. Based on these data, the LS.LMu.MEst.HedMac biotope has again been assigned, although with the absence of *Hediste*, this is a relatively poor fit, but with characterising species for other similar biotopes also absent (e.g. LS.LMu.MEst.NhomMacScr where *Hediste* is absent, but with the characterising species *Nephtys hombergii* and *Scrobicularia plana* similarly not present).

Table 1b. Intertidal Species Assemblage per Station and Biotope – Middle Shore

Yorkshire Forward intertidal 2010 (0.5mm sieve mesh) - Middle Shore															
MCS code		Taxon	Taxon qualifier	1 Middle	2 Middle	3 Middle	4 Middle	5 Middle	6 Middle	7 Middle	8 Middle	9 Middle	10 Middle	11 Middle	12 Middle
HD	1	NEMATODA		35	10	8	3	7	11	2	5	3	4		5
P	117/118	Eteone flava/ longa								1					
P	462	*Hediste diversicolor*													
P	494	*Nephtys*	juvenile												
P	672	*Scoloplos armiger*													
P	776	*Pygospio elegans*				3			1			1			
P	799	*Streblospio shrubsolii*		9	4	4	4	2	6	6	1	5	2	6	1
P	-	*Tharyx*	sp. "A"					4	2	2	2				
P	906	*Capitella*	sp. Complex	1											
P	929	*Arenicola*	juvenile												
P	1294	*Manayunkia aestuarina*		1											
P	1420	*Paranais litoralis*			6										
P	1479	*Heterochaeta costata*													
P	1490	*Tubificoides benedi*		136	12	4	5	4	10	16	56	3	4	2	15
P	1500	*Tubificoides swirenocoides*				1	1					1			
P	1501	*Enchytraeidae*													
S	616	*Corophium volutator*				35	10	32	10	1	12	4	2	70	27
S	1253	*Diastylis rathkei*													
W	385	*Hydrobia ulvae*		6	4										
W	1695	*Mytilus edulis*	juvenile						1						
W	2007	TELLINACEA	juvenile	1											1
W	2029	*Macoma balthica*		5		9	2		4	3	3	2	1	6	8
W	2064	*Abra tenuis*		3											
Total Abundance				197	36	64	25	49	45	31	79	19	13	84	57
Quantitative Species Diversity				8	5	7	6	5	8	7	6	7	5	4	6
Qualitative Species Diversity				0	0	0	0	0	0	0	0	0	0	0	0
Total Species Diversity				**8**	**5**	**7**	**6**	**5**	**8**	**7**	**6**	**7**	**5**	**4**	**6**
				LS.LMu.MEst.HedMac											

Table 1c provides the same information for the low shore communities. These data show the zone to have an invertebrate community with both a low abundance and diversity, with *Streblospio shrubsolii* the dominant species. Such low shore areas can feature an impoverished fauna and as such, the assemblage does not fit well within the existing biotopes, with the data indicating either an impoverished LS.LMu.MEst.NhomMacStr or LS.LMu.MEst.HedMac, with neither biotope fitting well with the recorded assemblage. Both of these biotopes have been recorded from north and south shores of the Humber (e.g. ABPmer, 2010; Elliott *et al.*, 2008).

Table 1c. Intertidal Species Assemblage per Station and Biotope – Lower Shore

Yorkshire Forward intertidal 2010 (0.5mm sieve mesh) - Lower Shore															
MCS code		Taxon	Taxon qualifier	1 Lower	2 Lower	3 Lower	4 Lower	5 Lower	6 Lower	7 Lower	8 Lower	9 Lower	10 Lower	11 Lower	12 Lower
HD	1	NEMATODA		1	5	1	1		3		1	1	4	1	3
P	117/118	Eteone flava/ longa													
P	462	*Hediste diversicolor*											3		
P	494	*Nephtys*	juvenile											1	
P	672	*Scoloplos armiger*			1										
P	776	*Pygospio elegans*			1										2
P	799	*Streblospio shrubsolii*				6	2	2	15	9	15	4	6	5	27
P	-	*Tharyx*	sp. "A"						1						
P	906	*Capitella*	sp. Complex												
P	929	*Arenicola*	juvenile				1	1							
P	1294	*Manayunkia aestuarina*													
P	1420	*Paranais litoralis*			1										
P	1479	*Heterochaeta costata*													
P	1490	*Tubificoides benedi*		1	1	2	1	1	1	1	1		3		3
P	1500	*Tubificoides swirenocoides*				15	1								
P	1501	*Enchytraeidae*													
S	616	*Corophium volutator*										2	15		71
S	1253	*Diastylis rathkei*												1	
W	385	*Hydrobia ulvae*													
W	1695	*Mytilus edulis*	juvenile												
W	2007	TELLINACEA	juvenile		1			1	1				1		
W	2029	*Macoma balthica*		2	4	2			1		1	1		3	
W	2064	*Abra tenuis*		1											
Total Abundance				5	14	26	6	5	22	10	18	8	32	11	106
Quantitative Species Diversity				3	7	5	5	4	6	2	4	4	6	5	5
Qualitative Species Diversity				0	0	0	0	0	0	0	0	0	0	0	0
Total Species Diversity				**3**	**7**	**5**	**5**	**4**	**6**	**2**	**4**	**4**	**6**	**5**	**5**
				Impoverished LS.LMu.MEst.NhomMacStr/HedMac											

Based on the above data, it is concluded that the biotope(s) present within the study area are characteristic both of the middle to outer Humber Estuary intertidal zone, being commonly recorded in this area. The biotope distribution based on these data are given in Figure 1.

Based on the MarLIN habitat information (Rayment, 2008), the biotope is intolerant of substratum loss but has a high recoverability and thus moderate sensitivity. It has a low

intolerance to smothering and a very high recovery with corresponding very low sensitivity and is tolerant of increased suspended sediment, noise and visual presence.

As such, although the biotope would be included within the suite of those covered under the Humber Estuary SAC designation, it is considered to have a relatively low sensitivity to marine activities, apart of course from physical habitat loss.

The biotope is an important feeding resource both for many fish species, notably flatfish and gobies and components of the assemblage constitute an important percentage of the diet of a many waders e.g. *Hediste diversicolor*, *Cerastoderma edule* and *Mya arenaria*. However, these species are not present in great abundance from the samples taken from the 2010 programme, and as the habitat is characteristic of many east coast estuaries and recorded from the Humber (e.g. ABPmer, 2010; Elliott *et al*., 2008), this loss is not considered to be particularly crucial to estuarine function at a wider Humber level.

2.2 Subtidal Biotopes

The following Table (Table 2) provides a summary of the invertebrate fauna recorded from each of the subtidal sampling stations, with the stations grouped per colour based on assemblage and associated biotope.

Table 2. Subtidal Species Assemblage per Station

Yorkshire Forward Humber Terminal May 2010 SUBTIDAL																														
MCS Code		TAXON	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
D	662	ACTINIARIA																					3									1
F	1	PLATYHELMINTHES																1										2			6	2
HD	1	NEMATODA		6						3		1	5			1				3			4			2					
K	45	*Pedicellina*																									p					
P	117/118	*Eteone flava/longa*	1																													
P	499	*Nephtys hombergii*							1	1																						
P	672	*Scoloplos armiger*																		5												
P	753	*Polydora cornuta*																					13									
P	799	*Streblospio shrubsolii*		3					3	11			22			5				1												
P	845	*Tharyx*								1																						
P	907	*Capitella capitata*	2		3	1					1			2	1		1		2	6		2	7		2	9	14	8	4			
P	919	*Mediomastus fragilis*		1																												
P	931	*Arenicola marina*	9		4	42			2														3				7	1	1			
P	1083	*Protodriloides chaetifer*																														1
P	1490	*Tubificoides benedii*				1			1	1			9																			
P	1498	*Tubificoides pseudogaster*																					1									
P	1500	*Tubificoides swirencoides*														1																
Q	53	ACARI																							1							
R	14	CIRRIPEDIA																														1
R	68	*Elminius modestus*																					14									
R	78	*Balanus improvisus*																					124									
R	142	COPEPODA												1								1	1	3		2	10	1	1	2		
S	76	*Neomysis integer*																													1	
S	86	*Schistomysis kervillei*						1																								
S	471	*Gammarus*																					1									
S	481	*Gammarus salinus*																										2				
S	616	*Corophium volutator*														1																
S	1197	*Bodotria scorpioides*																					1	1								
S	1253	*Diastylis rathkei typica*																					1									
W	1696	*Mytilus edulis*							2														11				1					
W	2007	TELLINACEA												1																		
W	2029	*Macoma balthica*			1	1				1						1																
Species Abundance			3	3	3	4		1	5	6	1	1	3	3	1	5	1	1	1	4		2	13	2	2	3	4	5	3	1	2	4
Colonial																											1					
Total Taxa			3	3	3	4		1	5	6	1	1	3	3	1	5	1	1	1	4		2	13	2	2	3	5	5	3	1	2	4
Total Abundance			12	10	8	45		1	9	18	1	1	36	4	1	9	1	1	2	15		3	184	4	3	13	32	14	6	2	7	5

Table 3 summarises the sediment type and associated biotope (based on the infaunal data in Table 2), using the same colour code groupings. The data indicate that the subtidal assemblage was generally impoverished, with some stations having no species present. Of the stations with an assemblage, *Capitella capitata* was present in most, a species generally

associated with environmentally stressed conditions (either physical, chemical or biological stressors). Other polychaetes such as *Streblospio shrubsolii* and *Arenicola marina* were present at some stations, with the former dominant at station 11 and the latter dominant in stations 1 and 4. Station 21 featured abundant barnacles (*Balanus improvisus* and *Elminius modestus*) together with mussels (*Mytilus edulis*) indicating the presence of hard substratum such as a cobble within the sample.

Such an assemblage is consistent with high energy and/or disturbed estuarine conditions, and presumably reflects the location of the majority of sampling stations within the main navigation channel on the south bank of the estuary and the maintenance dredging activity that is undertaken in that area. In fact during the survey the operation of a maintenance dredger was noted in the vicinity of the sampling locations.

Table 3. Subtidal Sediment Type and Biotope per Station

Yorkshire Forward Terminal Survey 2010 - Subtidal		
Station	Substratum	Biotope
1	Sand	Impoverished SS.SMU.SMuVS.CapTubi
2	Sandy Mud	Impoverished SS.SMU.SMuVS.NhomTubi
3	Sandy Mud	Impoverished SS.SMU.SMuVS.CapTubi
4	Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
5	Sandy Mud	Impoverished SS.SMU.SMuVS.CapTubi
6	Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
7	Muddy Sand	Impoverished SS.SMU.SMuVS.NhomTubi
8	Sandy Mud	Impoverished SS.SMU.SMuVS.NhomTubi
9	Sandy Mud	Impoverished SS.SMU.SMuVS.CapTubi
10	Sandy Mud	Impoverished SS.SMU.SMuVS.CapTubi
11	Sandy Mud	Impoverished SS.SMU.SMuVS.NhomTubi
12	Slightly Gravelly Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
13	Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
14	Sandy Mud	Impoverished SS.SMU.SMuVS.NhomTubi
15	Slightly Gravelly Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
16	Slightly Gravelly Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
17	Slightly Gravelly Sandy Mud	Impoverished SS.SMU.SMuVS.CapTubi
18	Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
19	Slightly Gravelly Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
20	Slightly Gravelly Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
21	Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
22	Slightly Gravelly Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
23	Slightly Gravelly Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
24	Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
25	Sandy Mud	Impoverished SS.SMU.SMuVS.CapTubi
26	Gravelly Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
27	Gravelly Muddy Sand	Impoverished SS.SMU.SMuVS.CapTubi
28	Sandy Mud	Impoverished SS.SMU.SMuVS.CapTubi
29	Muddy Sandy Gravel	SS.SSA.SSaVS.MoSaVS
30	Gravelly Sand	SS.SSA.SSaVS.MoSaVS

This level of activity, together with the high dynamics of the area, is likely to also have led to the absence of an invertebrate assemblage from several of the samples (Stations 5 and 19).

Based on the assemblage data provided in Table 2 and the sediment characteristics (summarised in Table 3), it has been possible to broadly characterise potential biotopes present at the sample locations. The extent of these are shown in Figure 1. However it is emphasised that the paucity of species from the samples means that in most instances, the

biotopes are not a close fit to the assemblage, and instead, are considered to be impoverished versions of them.

The majority of the survey stations were categorised as impoverished versions of SS.SMU.SMuVS.CapTubi. This biotope is characteristic of stressed areas of middle estuaries and is not considered to be of specific conservation importance nor sensitivity. It should be noted that stations 5 and 19 were grouped within this biotope based on sediment characteristics and general location, although both samples had no invertebrate infauna present, and theoretically might be regarded as barren.

A number of the stations, primarily in the infralittoral zone were classed as impoverished versions of SS.SMU.SMuVS.NhomTubi, although again with many of the characterising species absent from the assemblage. This biotope is associated with reduced and variable salinities subject to sediment deposition and mobility and as such may not form stable communities. Given its species composition, the biotope is not particularly sensitive to sediment loadings, and with the impoverished nature observed from the survey, is not considered to be of particular conservation importance at this location.

Stations 29 and 30 were classed as being SS.SSA.SSaVS.MoSaVS, this biotope associated with extremely mobile sand conditions in areas of strong tidal currents and potentially anthropogenic sediment movement. Again few of the characterising species were present, (single examples of *Arenicola marina* and *Neomysis integer*), so this may be regarded as being impoverished and care should be taken this association. As above, the assemblage is tolerant of rigorous tidal current conditions and sediment movement, and is commonly recorded from the outer to middle Humber Estuary (e.g. Elliott *et al*., 2008). As such, it is a biotope relatively tolerant of dynamic physical conditions and is not considered to be of particular conservation value based on the biological data available for the location.

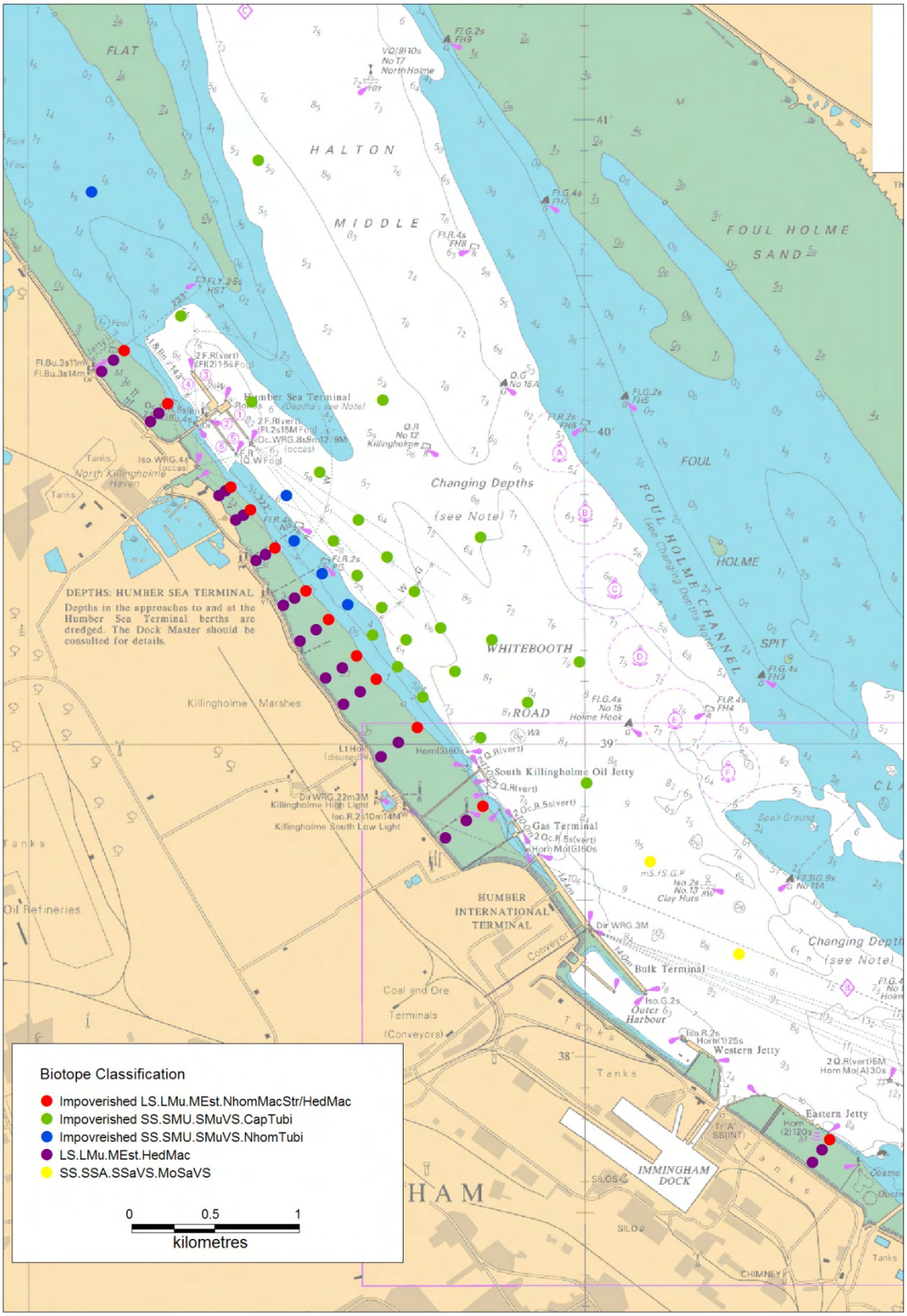

Figure 1: Biotopes Assigned to the Individual Sampling Stations from the 2010 Yorkshire Forward Survey Programme

3. DISCUSSION AND CONCLUSIONS

Based on the sediment and invertebrate sample data available for the intertidal and subtidal areas in the vicinity of the proposed development, it is not considered that the area supports any particularly rare or conservation priority biotopes. The intertidal zone supports an assemblage characteristic of the middle to outer estuary and given the species, some of these will provide a prey source for both fish and bird species. However, the data do not indicate that these species are present in elevated abundance levels (for the zone), and as such in combination with the resource extent, are considered simply characteristic of the intertidal foraging resource present in the middle to outer estuary on the Humber south bank.

The subtidal assemblage is largely considered to be impoverished in this area, based on the available data, this impoverishment presumably reflecting both the physical rigors of the location, with most sample stations present within the main estuarine channel, and/or also as a result of maintenance dredging activity. As such, it is not considered that the biotopes present within the study area of particular conservation importance, particularly given the impoverished nature of the associated infauna.

Figure 2 provides an interpolated indication of the likely biotope extent for the survey area based on bathymetric data together with the sediment and invertebrate characteristics.

The Figure suggests that there is a relatively strong association of subtidal biotope to depth, presumably also linked to dredging operation in the area. In the intertidal zone, again the biotope association would appear to be largely as a result of elevation, with the low shore area featuring an impoverished fauna consistent with other similar locations in the area and the higher energy of the zone.

In the subtidal area the majority of sample locations recorded an impoverished SS.SMU.SMuVS.CapTubi biotope although, with the limited assemblage meaning that this was only a partial biotope fit. The extent of the biotope would appear to include the majority of the Whitebooth Road and extend into Halton Middle. Much of this area is subject to maintenance dredging and it is likely that this activity will affect both the sediment characteristics and associated invertebrate assemblage.

Downstream from this area, and fronting the Humber International Terminal (HIT) there is an increase in depth, but again with an active dredging programme in operation. The assemblage in this area has been classified as SS.SSA.SSaVS.MoSaVS, although again the biotope tending to be a ‘best fit’ with an extremely restricted assemblage in terms of richness and abundance, presumably this being affected by the dredging activity.

A small restricted area of impoverished SS.SMU.SMuVS.NhomTubi has been identified running along the shallow sublittoral fringe for a section between the HIT and Humber Sea Terminal (HST), this then grading into SS.SMU.SMuVS.CapTubi. A further instance of this biotope was identified upstream from the HST, in the largely undredged spur channel.

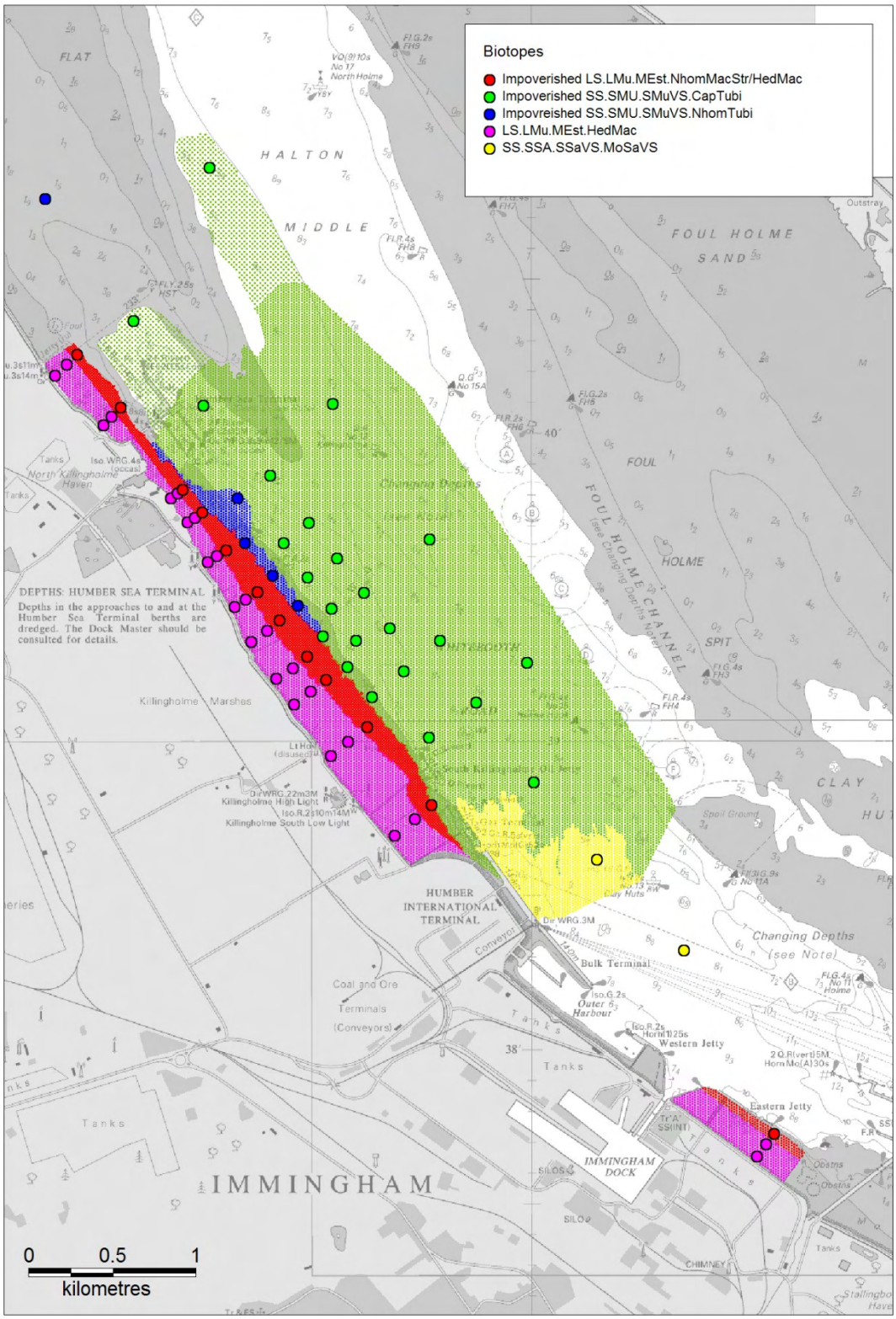

Figure 2: Biotope Location and Possible Extent based on Bathymetry

Running along the littoral/sublittoral fringe an impoverished version of the LS.LMu.MEst.NhomMacStr/HedMac biotopes was identified, this being in the largely higher energy low shore. With distance upshore (mid to upper shore) this then grades into LS.LMu.MEst.HedMac. This general intertidal biotope distribution was observed from transects between HIT and HST as well as from further up and down stream of the facilities.

Figure 3: Intertidal Biotope Location and Possible Extent (image Google Earth)

The distribution of these intertidal (and sublittoral fringe) biotopes is shown in Figure 3, with the low shore / sublittoral fringe biotope LS.LMu.MEst.NhomMacStr/HedMac covered by the tide (and probably only exposed at spring tide). The mid to upper shore LS.LMu.MEst.HedMac covers the majority of the remaining intertidal area which runs contiguously between the HST and HIT, and is commonly present along this section of the estuary.

4. REFERENCES

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