Marina Projects Ltd

Royal Southern Yacht Club:
Response to Lymington Technical Services Ltd Comments – Document 10264v1

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1. Introduction

1.1 Overview

ABP Marine Environmental Research Ltd (ABPmer) have been commissioned by Marina Projects Ltd to provide response to comments made by Lymington Technical Services Ltd (Doc 10264v1, Feb 2013) on the proposed marine works at the Royal Southern Yacht Club (RSrnYC) and RAF Yacht Club (RAFYC). The comments of particular interest are those that relate to the hydrodynamic and geomorphological assessment previously undertook by ABPmer (R.2012, Oct 2012).

1.2 ABPmer Experience

ABPmer is a leading UK marine environmental consultancy, offering a dedicated team of physical processes specialists who provide expertise in the assessment of marine, coastal and estuarine processes. ABPmer is a recognised provider of specialist capital and maintenance dredging services to the port and harbour industry, as well as having a strong portfolio of expertise in marina projects. In recent years, ABPmer have undertaken a number of studies within the Hamble, including more recently, the River Hamble Maintenance Dredge Plan (2011) and the Deacons Boatyard Dredge – Hydrodynamic Assessment (2011).

The hydrodynamic and geomorphological assessment carried out for the proposed RSrnYC and RAFYC marine works (ABPmer, 2012) was undertook by Peter Whitehead (Project Director) in collaboration with Dr Benjamin Carroll (Project Manager). Following this collaboration, the assessment then went through Quality Assurance procedures accredited to ISO 9001:2008, for the delivery of Environmental Consultancy and Research Services. As such, the assessment was also subject to review by Claire Brown (Quality Manager). A brief description of their respective experience is provided below.

Peter is an Associate with speciality in geomorphology and dredging issues and is a Chartered Member of the Institution of Water and Environmental Management, a member of the PIANC Environmental Commission and a Chartered Geographer. He has 30 years experience working in the fluvial, estuarine and coastal environments, particularly with respect to understanding physical processes, geomorphological interpretation, environmental assessment and management. Over 15 years of this period he has been involved with evaluating the impacts of dredging in the coastal and estuarine environments. This experience includes the licensing of dredging and dredged material disposal, including the development of dredge management, and mitigation and monitoring plans as well as practical evaluation of beneficial use options. Peter has extensive experience in the specification of dredge campaigns to meet port operational requirements whilst satisfying environmental standards, particularly with respect to the requirements of the Birds and Habitats Directives. Peter routinely advises ABP's 21 ports on dredging and environmental matters.

Ben joined ABPmer in 2009 after undertaking research for a PhD on the 'Morphodynamic Impacts of a Tidal Barrage in the Mersey Estuary', which examined both short and long-term impacts that a tidal barrage has on sediment transport under tidal conditions in the Mersey Estuary, and hence morphological changes. Since joining ABPmer, Ben has developed dredging protocols for ports around the country and has undertaken numerous process studies and geomorphological assessments in marine, coastal and estuarine environments (including within the River Hamble).

Claire Brown is an environmental scientist with 26 years experience in the field monitoring techniques for baseline surveys and long term monitoring campaigns. Claire has experience of a wide range of hydrographic surveying techniques and has been extensively involved in dredge surveys and monitoring programmes, including operational monitoring to ensure compliance with environmental targets. In addition Claire has managed a variety of Environmental projects including the production of Environmental Statements and preparation of information for Appropriate Assessments and Public Inquiries. Claire represents ABPmer within the MEDIN partnership and is an Associate Fellow of the Royal Institute of Navigation, Fellow of IMarEst and a member of the Hydrographic Society.

2. Comment Response

ABPmer have reviewed the comments made by Dr Paul Tosswell (Lymington Technical Services Ltd) and have identified a number of comments that would call for a response, these responses are provided generally in Section 2.1. However, given the repetition of comments relating to the 'potential' for erosion of the intertidal directly to the south of the RSrnYC, a more comprehensive response to this matter is provided in Section 2.2.

2.1 General Comments

- **Page 6:** Bathymetry - In terms of the bathymetry (depths) it is stated that no data (apart from indicative) is available from the shore to 48m off the quay. *Note – this is the actual area that the dredging is proposed so some caution must be placed on assessments (it is highly unusual for no survey data to have been collected). It is known that depths at the existing wall at shallower than 2m ACD so the depth of removal at this point will be around 4m.*

As stated in the ABPmer (2012), although bathymetric readings were not available inshore of the inner shore-accessible pontoons (this was due to access issues presented by the shallow bathymetry and the pontoons/vessels), however, 2008 LiDAR data (available from the Channel Coastal Observatory (CCO)) in combination with visual inspection provided sufficient information for an analysis to be undertook. The cross-sectional profile presented in Figure 6 of ABPmer (2012) clearly identifies the shallower areas which are to be removed. As such, all efforts were made to use the best available information.

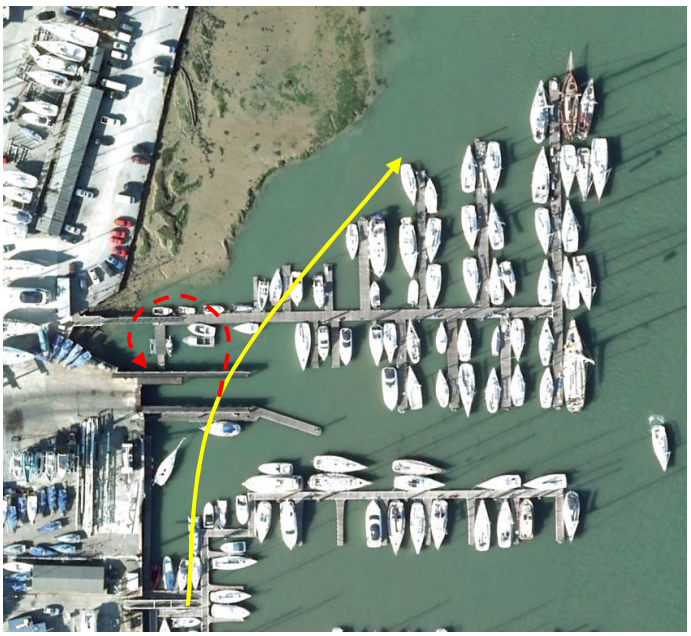
- **Page 7:** With regard to the report it states on the flood tide that 'flows are generally pulled towards the western bank (on the outside of the bend) due to the location of the deeper channel but also to accommodate the deepened areas of Port Hamble Marina, situated to the north, whilst flows within the main channel generally follow the alignment of the estuary'. Note – this is a little confusing, it is true to say that Port Hamble will attract the flow (because the water takes the path of least resistance) but this effectively means that the flow velocities will be lower in this region. There is insufficient information provided to demonstrate flow directions, if the bend is significant (in hydraulic terms) then one would expect the flow directions to alter with depth (the so called 'helicoidal flow').

ABPmer would like to point out that the paragraph mentioned is solely discussing the direction of the flow, differences in direction along the estuary in relatively close proximity to the RSrnYC (both within the main navigation channel and within nearby marinas), and not flow velocities. The available information shows an attraction of flow towards Port Hamble Marina (Point A) on

the flood tide before redirecting back towards the main navigation channel (Point C), a process which is to be expected given the bend in the estuary at this location and the presence of the deepened marina (as later confirmed by Paul Tosswell). As such, ABPmer believe that there is sufficient information to provide an indication of flow directions within this reach of the estuary.

- **Page 8:** It is also true that the flood tide passes through Port Hamble and exits to the NE towards the main channel. Because of the shape of the dredging at the upstream end of Port Hamble the formation of an eddy at the upstream location is unlikely.

Based upon the shape of the dredge pocket, the presence of the vessels and the general realignment of tidal flows towards the northern end of Port Hamble Marina, it is expected that a small eddy will be created in the north-west corner (shown on image), particularly on the rising tide before the upstream intertidal becomes submerged. This being said, the presence of an eddy (or not if the case may be) will not be affected by the proposed works.



- **Page 8:** The reference to the peak flow velocities being higher at Points C & D should be ignored as they were taken on a much larger spring tide (i.e. Points A & B cannot directly be compared to Points C & D).

ABPmer agree that due to the difference in tidal ranges between points A and B and subsequently C and D makes a direct comparison between flow velocities impracticable, however, neap tidal flows at Point C (with a tidal range of 2.0m – not included in the report) are similar to those recorded during a spring tide at Point A (with a much larger tidal range of 3.5m). As such, it can be inferred that the flow velocities at Point C are greater than those at Point A (if the tidal ranges were the same), and that this increase is due to the narrowing of the estuary at the northern end of Port Hamble marina.

- **Page 8:** This deals with the impact assessment of the proposed development. The first paragraph states that the flow regime in the vicinity of RSrnYC is largely controlled by the bend of the estuary and to a lesser degree by the flow through Port Hamble Marina. This is misleading in that Port Hamble does have a significant effect on the flows in this region.

The main flows in the estuary are derived from the estuary shape, which is then modified by the presence of Port Hamble Marina. As such, the statement in ABPmer (2012) is factually correct.

- **Page 8:** Tidal effects – The capital dredge will increase the cross-section locally to RSrnYC by 114m2, this increase will have an effect on the tidal flows. The reference to intertidal is misleading (actually intertidal means between low water and high water not MLW) although due to the size of the estuary tidal prism (the volume of water that enters and then leaves the estuary per tide) any dredging of intertidal will produce very small percentages. In terms of tidal prism the effect will be negligible.

ABPmer agree that intertidal is between low and high water, but MLW was used in this instance to put the change into context for environmental purposes. It is also agreed, as pointed out in ABPmer (2012), that the proposed changes to the intertidal will be negligible with respect to its impact on tidal prism.

- **Page 8:** Tidal Effects Flood Tide - It is broadly correct that the flood tide will move slightly to the west and also true that this will lead to local acceleration at the SW edge of the dredge (Hamble Hard and to a lesser degree Hamble Jetty). The references to variations in peak flow velocities are stated without sufficient supporting information and should be disregarded.

As described in ABPmer (2012), the proposed works will have an impact on tidal flows in the area, which will in turn lead to a slight increase in flow velocities in the region of Point A due to its proximity to the dredge area. It is thought that any increase is likely to be less than 5%, which would be *circa* 0.01 to 0.02m/s (over a baseline of 0.35m/s, which represents a spring tidal range of 3.5m). This slight increase will vary slightly between differing tidal ranges (i.e. smaller and larger tidal ranges), but are unlikely to be greater than 0.03m/s (i.e. the measured velocities at Point C during a much greater tidal range – 4.75m).

- **Page 9:** It is suggested that at the southern end of the works (a right angle dredge) the tidal flows will head back to the main channel directed by the remaining section of intertidal area near the slipway. This seems to ignore the effect of the proposed dredge profile which will have a much more significant impact than implied and it is doubtful that the remaining intertidal area will smooth this out quickly.

All comments relating to the potential erosion of the intertidal to the south of RSrnYC will be discussed in Section 2.2.

- **Page 9:** It is stated that these ebb flows will be constrained within the development site as tide levels lower but this suggests that the flow directions will alter

ABPmer (2012) states that '*as tidal levels continue to fall over the ebb tide, these effects will be minimised as the flows exiting the RSrnYC will become more constrained to the main channel, and will not be able to accelerate across the higher elevated intertidal area*', rather than constrained within the development site.

- **Page 9:** It is stated that under flood conditions there will be a small amount of erosion between the Hamble Jetty and the RSrnYC (i.e. across the end of the hard) which will cease after a few tidal cycles. This is considered rather conservative, the change in flow

direction locally will be significant and no evidence has been provided to support a stable regime occurring after a few tides.

All comments relating to the potential erosion of the intertidal to the south of RSrnYC will be discussed in Section 2.2.

- **Page 9:** It is stated that the 'removal of the intertidal in front of the RSrnYC will further increase the efficiency of tidal flows'. In order to increase the efficiency of flow it is necessary to align the channel with the flow so that no local disturbances (corners etc.) impact on the flow. This is not the case here. The comment regarding reducing siltation rates at the SW corner of Port Hamble is considered unlikely and any change would not be measureable. (Note – this area is not currently dredged due to concerns regarding the stability of the slipway and quay wall).

If the SW corner of Port Hamble Marina was dredged, it would rapidly silt up due to the nature of the hydrodynamics (i.e. the eddy) at this location. The removal of the intertidal in front of the RSrnYC would allow the tidal flows to move more parallel to the bank, and thus reduce (or remove) the eddy. This would therefore reduce any sedimentation that occurred in the SW corner of Port Hamble Marina, should they want/need to dredge here in the future.

- **Page 10:** It is stated that on the ebb tide there will be some erosion to the south of the development and this is stated as being limited in duration and scale. As for the flood tide this is questioned and the effect is likely to be greater than implied.

All comments relating to the potential erosion of the intertidal to the south of RSrnYC will be discussed in Section 2.2.

- **Page 10:** It is true that the main flows will be more attracted to the western side of the estuary. It is also true that the eddy might move from Port Hamble to the RSrnYC. However, the flows at the southern margin of the dredge are likely to cause issues which will not be short term. The suggested changes in sedimentation are unlikely; it is more likely that Port Hamble will remain as is. It is obviously true that the RSrnYC will suffer increased sedimentation.

If Port Hamble Marina were to dredge in the SW corner, sedimentation rates would be relatively high due to the eddy that is currently present (in comparison to other areas of the marina). The removal of the eddy would lessen these sedimentation rates, should they decide to undertake maintenance dredging within the SW corner in the future.

- **Page 10:** It is not agreed that the erosion potential to the south of the development will be short-lived. The dredge will increase the flow velocities (as the report states) but such flows are likely to cause erosion at points of discontinuity such as the southern end of the dredge which the flows will meet nearly head-on. This is why in all recent cases of capital dredging on the river the dredge profiles have been designed with a flare to allow smooth flow to minimise erosion (compare the difference between a T junction and a slip road and you get the idea).

All comments relating to the potential erosion of the intertidal to the south of RSrnYC will be discussed in Section 2.2.

- **Page 11:** The document concludes that overall the impact will be small and local to the development site – this is not agreed with.

ABPmer (2012) concludes that '*any change as a result of the proposed development will not adversely affect the overall integrity or functioning of the estuary*'. Any changes to the hydrodynamics associated with the proposed works will likely be confined to less than 50m to the south of the RSrnYC (over the ebb tide). As such, the spatial extent of any impact is considered to be local to the proposed works. The scale of impact, i.e. whether or not the proposed works will have a minor or significant impact on the intertidal to the south, will be discussed in Section 2.2.

2.2 Comments Relating to Erosion of the Intertidal to the South of the RSrnYC

The potential effects of the proposed marine works on the intertidal found between RSrnYC and the hard slipway to the south have been discussed at numerous points within ABPmer (2012). The main points identified are:

> '*the redirected flows exiting the RSrnYC dredge area are likely to accelerate slightly, potentially leading to a slight increase in flow velocity over the end of the intertidal area immediately below*'
>
> *'there is also likely to be a minor amount of erosion potential to the undesignated intertidal to the south (between the RSrnYC and the Hamble Ferry Jetty) caused by an increase in flow velocities during both flood and ebb tides….however, erosion of this intertidal area will be limited in scale and will occur shortly after completion of the dredge works'*
>
> *'erosion of this intertidal will be limited in duration and scale'.*

As indicated within ABPmer (2012), changes in the hydrodynamic processes will occur as a result of the marine works, which will subsequently lead to flow increases across the aforementioned intertidal area. As a result of this change, there is an increased potential for erosion of this intertidal area, however, the extent and scale of this erosion will largely be controlled by the density of the material present. As detailed within Section 3.4 of ABPmer (2012):

> the *'sediments in the vicinity if RSrnYC will be predominantly be mud with a density in the order of 1300kg/m^3 or greater due to the absence of dredging. The density of this mud is also likely to increase with distance up the intertidal (towards the bank)'*.

It should also be recognised that aerial photographs and site visits have identified that the intertidal area also comprises some gravel content, which further increases the density of the material at this location; i.e. above 1300kg/m^3. Density of the intertidal sediments will also increase with depth through compaction and subsequent consolidation.

Taking a value of 1300kg/m^3, i.e. weaker/less consolidated sediments than those expected, it has been calculated that erosion shear stresses in the region of 0.96 Nm^{-2} (Mitchener et al., 1996) to 1.82 Nm^{-2} (Delo and Ockenden, 1992) are required to erode the sediments found across the intertidal area. To put these values into context, flow velocities in the order of 0.85 to 1.2m/s (Whitehouse et al., 2000) would be required to sufficiently erode these sediments.

Based upon the flow velocities measured in the region of RSrnYC, and any likely increases that are likely to result from the proposed marine works, ABPmer (2012) came to the conclusion that due to the relatively consolidated nature of the sediments found across the intertidal area, the sediments will provide good resistance to increased erosional forces of the tidal flows. Any erosion of this intertidal is likely to occur at the lower end, particularly at the surface, where the sediment will be less consolidated. At this location any potential erosion will occur relatively quickly over spring tides (when flow velocities are greatest), until a new morphodynamic equilibrium is met. Taking all of these factors into consideration, ABPmer are still confident that any erosion of the intertidal found between RSrnYC and the hard slipway to the south will be limited in duration and scale, and any change will not adversely affect the overall integrity or functioning of the estuary.

ABPmer would further like to point out that the predicted 15m of intertidal erosion put forward by Dr Paul Tosswell is an over exaggeration, and does not take into account the expected density of the material found across the intertidal area, nor does it consider the flow velocities required to drive such erosion. As such, his further comment that the '*proposed dredge area is considered likely to generate a potentially significant negative impact on the shallow areas to the south of the development area'* is also exaggerated based on the available evidence.

In addition it should be noted that the slipway extends a further 12.5m east (i.e. into the river) than shown on the previous plans, and that following a site inspection, the slipway (made up of a hardcore base and edged with hardwood timber sections) would appear to be creating a 'control point' in this area. Due to the position of the slipway, falling within *circa* 5m of the dredge pocket, any potential erosion of the intertidal between the slipway and dredge pocket would be limited to this distance (i.e. less than 15m). This being said, the calculated bed shear stresses (and associated flow velocities) likely to occur at this location following the proposed marine works will not be sufficient to cause significant erosion.

3. References

ABPmer, 2012. Royal Southern Yacht Club: Hydrodynamic and Geomorphological Assessment. ABP Marine Environmental Research, Research Report R.2021.

Delo, E. and Ockenden, M., 1992. Estuarine muds manual. HR Wallingford Report SR 309.

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Mitchener, H., Whitehouse, R., Soulsby, R., and Lawford, V., 1996. Estuarien morphodynamics. Development of SeaErose – instrument for in-situ mud erosion measurements. HR Wallingford Report TR 17.

Whitehouse, R., Soulsby, R., Roberts, W. and Mitchener, H., 2000. Dynamics of estuarine muds. Thomas Telford. ISBN: 0 7277 2864 4. 210p.