7. DISCUSSION

The RHHA has facilitated a research approach to investigating the spatial condition of saltmarsh and mudflat areas in the River, possible causal factors for change, and opportunities for future management where appropriate. This is in response to concerns developed within the Harbour Authority and also promoted by stakeholders, resident groups and individuals with regard to potential saltmarsh and mudflat erosion in the River; it is also in response to demand for opportunities for reuse of dredge spoil sought by both developers and regulators. The study is not exhaustive, as formal investigation into all factors implicated would necessitate long term research and analysis of a multifactorial approach. However it is, as far as possible, a comprehensive consideration of readily available literature and data on the status of Hamble River intertidal and saltmarshes habitats, sediment information, factors potentially involved in causing change, and the potential for restoration/management of sites. This is set against wider global research papers and grey literature which have clearly identified that the challenges facing Hamble saltmarshes are similarly noted in locations elsewhere.

The information provided has been subject to analysis and discussion throughout the document. Reasons for decline, analysis of change, the potential effects of dredging, possibilities for restoration and related environmental effects have all been considered. This has led to a series of conclusions which will assist the RHHA and associated stakeholders to consider next steps. Whether this leads to saltmarsh restoration schemes at small or large scales can now be considered at an informed level, as can any supporting studies that may be required for suggested approaches given here

The outcomes of this study have put the Hamble marshes into a wider context whilst focussing at the local level of difficulties. Accordingly the study indicates that:

- The reasons for decline in Hamble saltmarshes are multifaceted as seen in other locations. The most significant decline was land removal and reclamation for marina construction during the 1960s and 1970s. In addition to this, climate change, sea level rise/waterlogging and coastal squeeze have been implicated, particularly in areas protected by engineering restricting saltmarshes ability to achieve a natural retreat. These factors have been directly attributed to Hamble marsh decline, but also coupled with less well understood mechanisms, notably *Spartina* die back and the potentially enhanced waterlogging effect of the hybrid *Spartina anglica*. Dredging effects from marina construction combined with the Hamble sediment system accreting were suggested to achieve *"balance"*. Overall, as noted by other researchers, it appears likely that the encompassing effect on marsh decline in the Hamble is one of synergy. With gross environmental change the primary factor, exacerbated by human mediated influence at the catchment scale;
- The implications of dredging on the Hamble soft sediment features were specifically investigated. Work has indicated that maintenance dredging can have very localised effects. However, research suggests that drawdown occurred after the marine development works of the 1960s-1970s, as the Hamble sediment system shifted toward equilibrium. Effects were suggested to include edge erosion and height loss as sediment supply decreased. In addition, localised effects have been suggested in more recent times at Mercury Marina, Hamble Point and Deacons; though the latter has no direct proximity to an existing marsh, Bursledon Marsh having disappeared by the 1970s due to marina and yard development;
- Investigation into whether the maintenance dredging regime reduces sediment supply to soft sediment features revealed conflicting opinion. Certain research concluded that the complete

removal of dredged sediment from the Hamble system, through deposition at offshore disposal sites, meant that intertidal mudflat and saltmarsh did have a reduced sediment supply to counter sea level rise. However, it has also been noted by other researchers that some intertidal areas and saltmarshes have accreted vertically in line with increasing inundation and associated sediment supply. Overall it was recognised that the Hamble is part of the wider Southampton Water system and that the River receives most of its fine material from marine sources (the River is flood dominated thus the major source of sediment is transported erosional material from the wider Southampton water / Solent system). Thus, by extension, sediment changes in the wider system also have implications for the Hamble, in conjunction with localised dredging in the Hamble (it was noted that ongoing maintenance dredging *may* reduce sediment supply to upstream areas) and the historic system change through marina creation;

- With regard to the suitability of dredged arisings for possible use in beneficial projects, particle size data for River Hamble sediment are rare. However, data were available for some upstream locations allowing assessment of sediment consistency. This showed sediment to be slightly gravelly muds and sandy muds. As the sediments dredged from the River, allowing for coarser material, will generally comprise that which could have deposited on intertidal soft sediment features, it is assumed the arisings will be suitable on physical aspects alone, though this will need clarification through testing. Chemical and organic content will require analysis and PSA data will be collected on a case by case basis to support any projects taken forward;
- From the above information, it is reasonable to consider that the dredge arisings are at least potentially suitable for restorative works on River Hamble soft sediment features. This is set in the context of thresholds for pollutant levels and organic material requisite for successful marsh colonisation. Studies would be required to confirm these aspects and, whilst contaminants are recorded (most recently) as below Action Level 2 and sediments are licensed for at sea disposal, it should be remembered that pollutants can exist in pockets and can affect sensitive ecological systems therefore appropriate replicated sampling may be useful prior to any beneficial use;
- The suitability of Hamble River marshes for beneficial use restoration required consideration of numerous factors including those that led potentially to decline in the first place, those that may lead to material being suitable for restorative works, and the location of saltmarshes which may be suitable. Overall, whilst recognising that a cautionary approach has led to little work of this nature in the region, equally, restorative projects for use of dredge arisings on already stressed habitats requires careful thought and may have regulatory issues;
- The MCA approach used here provides an overview of marsh status in relation to factors assessed, and provides a framework for decision makers to differentiate between potentially suitable sites. The qualitative assessments are highly simplified, and the judgements of the research team should be tested by a stakeholder group before decisions are made. It should also be noted that at this stage the criteria are unweighted, *i.e.* they are all assessed to be of equal value. When moving forward with site-selection a stakeholder group may decide that certain criteria are more important than others and should be weighted accordingly. This may alter the outcomes of the MCA;
- If a beneficial use or retention scheme is considered further as a result of this, or further supporting work, it is recommended that suitable liaison, consultation and appropriate

targeted studies proceed, *e.g.* sediment dynamics, localised impact assessment, and suitable deposition and retention methods. But note, this report has also discussed that smaller projects may not require greater detailed study, allowing for a pragmatic view by regulators and stakeholders;

- As with many soft sediment intertidal and coastal habitats in the UK, the marshes in the Hamble are subject to significant stressors, many of which have been discussed here. The *perceived barriers* to beneficial use of sediment may be overcome by alternative approaches, *e.g.* passive sediment retention methods. Consideration of structures used in UK schemes was undertaken, with local (River Hamble) evidence that appropriate attempts to enhance sediment settlement can work; as seen (albeit some time ago on a small creek section) at Lands End and, at Little Marsh (time unknown, but believed to be in the 1920/30s). Considering inherent risks, suggestions have been made for potentially appropriate methods to use at Hamble intertidal mudflats and saltmarshes, though it is an imperative that these are considered at the appropriate scale with suitable consultation and supporting data. Following these processes and procedures, there may be an opportunity for a realistic trial / small scale project in the River;
- The environmental and societal benefits of saltmarsh and mudflat restoration are much clearer as a result of recent research developing our understanding of the inherent value of these habitats and systems. The ecosystem service concept helps to clarify the value that soft sediment habitat features have at the individual and community scale, and to society as a whole, and their role in sustaining healthy marine ecological communities and systems is increasingly apparent, as is their relative fragility;
- Enhancement of ecosystem service, notably through the provision of naturally resilient coastal protection services and, by extension, ecological value of highly conserved sites can only be a positive outcome. However, to deliver these benefits the involvement of an active community and commercial and private river users is highly desirable, most likely critical. The benefits must be discussed in conjunction with the risks to ensure the aims of a pragmatic approach are achieved;
- Environmental impacts from beneficial use are difficult to discuss other than at the general site level. Therefore, should a site-specific project be conceived, it should be supported with an appropriate level of impact assessment. Effects on conservation features from sediment suspension may include smothering resulting in physical habitat loss, and short term effects on water quality and related ecosystems/communities and species (e.g. fish and shellfish). Equally, physical placement can cause disturbance effects thus timing will be a significant issue with avoidance of bird nesting and overwintering periods being a likely requisite, though this may prove awkward as most dredging is undertaken in the winter period. Any beneficial scheme should engage at an early stage with the statutory and technical advisory bodies and regulators, local authorities, along with notable non-governmental organisations, and local representatives groups, in addition to the stakeholder groups highlighted in the preceding point;
- Sediments deposited at recharge locations can, potentially, be redistributed within the system and may be deposited in less welcome locations, such as the navigation channel or re-deposited within the marinas. Conservative assessment undertaken here indicates that there is a risk, but relatively recent works at Lymington showed the benefit of retention structures coupled with sediment placement. Whilst there are risks of sediment redistribution, these are

likely to be reliably short term, and when considered against the potential (conservation and ecosystem service) benefits, such projects should be evaluated and where feasible taken forward to actual outcomes;

- Financing for beneficial use trials/projects or sediment retention approaches is potentially difficult in a current UK atmosphere of limited public funds and future political uncertainty. There are possible funding roots through philanthropic sources, or through engagement with user groups and the local community, plus landowners may be able to supply *"in kind"* value.
- The potential costs associated with additional works have been presented, however, to obtain detailed costs would require a specific project description, and would be commercially confidential. Accordingly, reasonable estimates based on experience and a previous Solent based beneficial use scheme, have been supplied as guidelines.

In summary, aspirations for beneficial use or sediment retention studies or projects in the River Hamble should be taken forward to practical outcome if the support and agreement can be achieved. The possible benefits may well outweigh the risks, and whilst success is by no means guaranteed, the possibility to take such a scheme past the talking stage is a useful opportunity for the RHHA and any project partners. It would also be used as an example for other similarly pressured estuaries in the UK.

8. CONCLUSIONS

- This study should be viewed as an end point to this research approach, at least for the Hamble. It is considered that the next step is either to decide to do nothing, or to take forward a practical trial/project for beneficial use of dredge spoil or retention options. Subsequent need for detailed research/modelling will be defined by the scale of project considered plus regulator opinion, with smaller schemes benefiting from a pragmatic approach;
- The work identifies that the major saltmarsh loss period was in the 1960s-1970s when physical removal for the creation of marinas was undertaken on the River Hamble. Subsequent loss is mainly considered to be related to coastal squeeze and sea level rise, though other complex biotic and abiotic factors have had a role in saltmarsh decline;
- In considering dredging, there is a clear distinction between historic construction impacts and ongoing maintenance dredging, the former having had significant deleterious effects, the latter being less clear. Research results on causality in the River Hamble are ambiguous. Currently there is no clear proven relationship that dredging is increasing saltmarsh decline at the estuary level, however it is apparent that it has caused localised impacts;
- On the basis of currently available data, saltmarsh at the Hamble Estuary level have not declined significantly in recent years, however local variance to this does exist with some fragmentation and erosion apparent. However, these more recent variations are somewhat clouded by the accuracy of the available data which can over or underestimate change;
- From this point forward, monitoring of further change or loss can be undertaken with a good level of accuracy using terrestrial LiDAR. The high resolution, small error margin (compared to satellite/aerial) and repeated application will provide a highly useful dataset against which future change can be measured and protection of the saltmarsh optimised. This can also be applied to assess the efficacy of any restoration or retention scheme. It has no immediate financial benefit, but is strongly recommended for the longer term to enable accurate monitoring of soft sediment habitat change in the River Hamble;
- No locations have been clearly identified for major beneficial reuse projects. This may be discussed in more detail by stakeholders and regulators, but the evidence given here does not support a major beneficial use scheme. However, small viable independent projects could be undertaken by interested parties with support from stakeholders. On localised scale the following projects can be suggested:
- Lands End (Hacketts Marsh) – sediment retention structures to offset fragmentation and to demonstrate viability of such schemes;
- Satchell Marsh - management measures through either do nothing other than control access, or set up sediment retention structures to decrease damage to marsh through artificial creeks created by residents and significant loss through marina creation;
- Little Marsh – options from localised recharge at edge, retention structures and improved drainage to promote growth of lower marsh at “cliffing” edge;
- Hamble Common Marsh – potential for small scale beneficial re-use in conjunction with sediment retention structures plus options to manage localised dredge draw down factor.
- Whilst such projects might seem small scale in terms of the Hamble Estuary overall, it is important to understand that the cumulative effects of such projects could be of net benefit to the soft sediment habitats in the Hamble;

- More schemes could be considered which comprise:
- Bunny Meadows North and South – consider sediment retention and possible recharge, but, only feasible with significant modification of inlet/outlet culverts to control/reduce very high tidal flows;
- Swanwick Marsh – possible use of sediment retention structures to promote localised low marsh colonisation. Recent *Spartina* growth suggests this may be feasible, but this will be a larger scale, longer term scheme.