GUIDANCE NOTE:
SILTATION AND SEDIMENTATION

WHAT IS SILTATION?

Mud, silt and sand are never too far away from recreational boaters – but what actually is it and where does it come from? Figure 1 shows the possible sources:

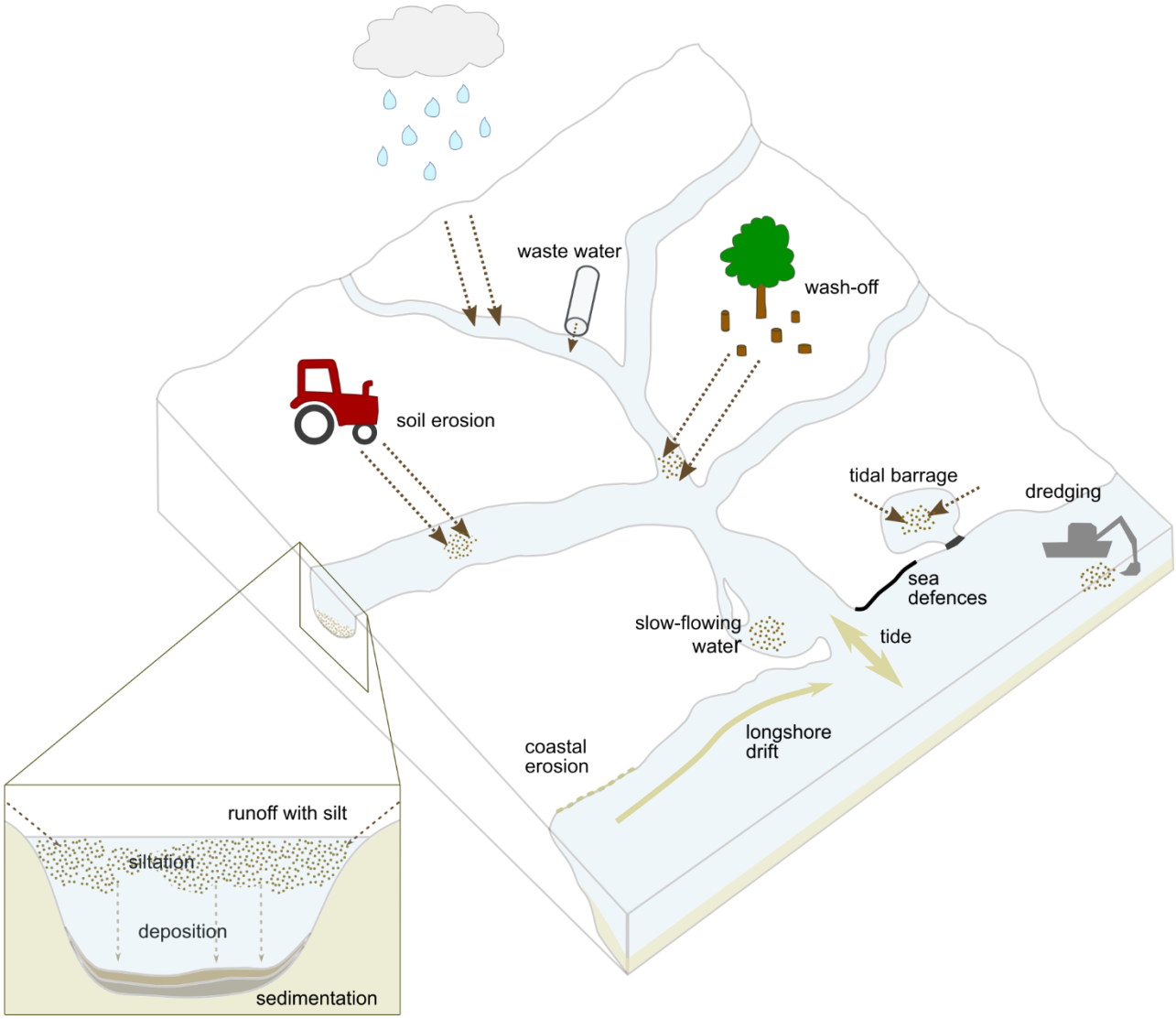

Figure 1 - Possible sources of siltation and sedimentation

Fine sediments within lakes and rivers mostly originate from the weathering and erosion of rocks. Following rainfall, soil can enter lakes and rivers which cause the finest particles to become suspended in the water, making it look dirty; this is known as ***Siltation*****.** Particles may eventually find their way to the lake or river bed where they become deposited; this is known as ***Sedimentation*****.** In rivers, fine particles may be transported some distance and become deposited downstream creating mud or sand banks that will make the water shallow. Sedimentation is a natural process that will occur in healthy rivers and leads to the creation of soft sediment habitats

that are important for wildlife. However, it can be exacerbated as result of excessive soil erosion caused by poor land management practices, the discharge of waste water that contains sediment, and the dumping of dredge spoil. Different regions of the country may experience varying amounts of siltation, depending on what kind of activities and land use are present within the drainage basin.

Mudflats and sandbanks are common features in estuaries, where suspended sediment is also brought from the sea as a result of coastal erosion and longshore drift. The rate of sedimentation is likely to change naturally with time as the shape of the estuary alters in response to variable water and weather patterns. In sheltered regions, sedimentation will occur more readily and cause shallows, and where there are eroding channels there will be deeper water. Sandbanks and mudflats comprise natural features and important habitats, which also contribute to coastal protection and prevent bank erosion. The amount of sand and mud may rise in response to increased erosion around the coastline, or fall as a result of increased coastal protection.

HOW DOES IT AFFECT CLUBS?

The 2016 RYA Vital Signs Survey (Arkenford, 2016) was an online survey sent to RYA affiliated clubs to understand some of the issues facing them, to which about a third of clubs responded. There was an increase from around 1 in 5 clubs noting an issue with siltation/sedimentation in the 2010 survey (Arkenford, 2010), to 1 in 4 clubs in 2016. Of those clubs mentioning an issue with siltation/sedimentation in 2016, just under two-thirds utilise tidal waters. A quarter of clubs that mentioned siltation/sedimentation in 2016 are in the East region (4 in every 10 clubs in the region, of which three-quarters use tidal waters), and a further fifth in the London and South East region (around 3 in every 10 clubs in the region, of which about half utilise tidal waters). Figure 2 provides further information as to the proportion of clubs in each region that noted an issue of siltation/sedimentation (left map), and the division of these by water type (right map).

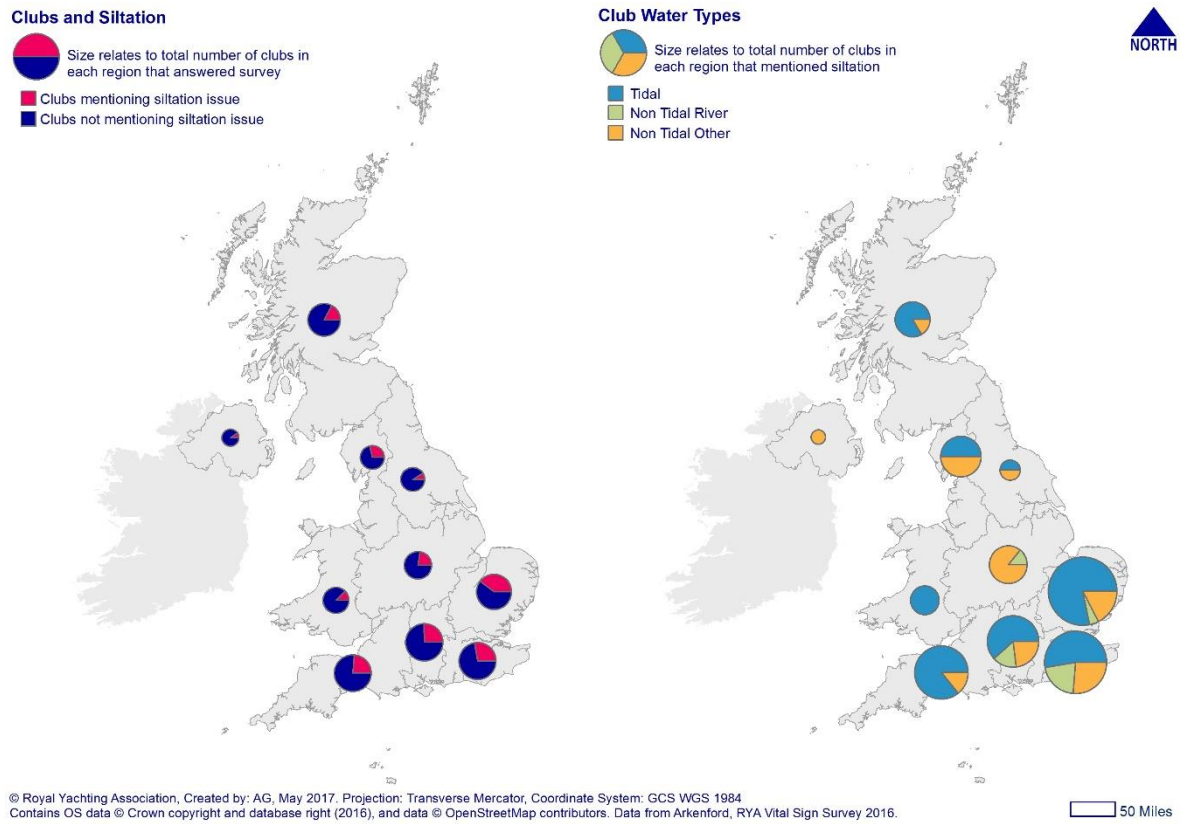

Figure 2 - Clubs noting an issue of siltation/sedimentation (RYA Vital Signs Survey 2016)

WHO OWNS THE RIVER, LAKE, ESTUARY AND SEABED?

As usual with the law, it is complicated. Nobody owns the water in the sea or in rivers, but there are usually rights associated with this water that may be enjoyed by particular groups. Ownership of a river or lake bed is usually associated with the riparian owner, but not in tidal waters. If your land boundary is next to a watercourse it is assumed you own the land up to the centre of the watercourse, unless it is owned by someone else. See the guidance for England, Scotland, Northern Ireland, and Wales for more information. Navigation rights on a non-tidal river or lake are also usually associated with the riparian owner unless it is on a public navigation. In tidal waters, the seabed to 12 nautical miles is largely owned by the Crown and managed on its behalf by the Crown Estate Commissioners, as is much of the foreshore. The remainder is in a mixture of public and private ownership.

About the only situation in which you can readily control siltation and remove accumulated silt is if you own all the land around a totally enclosed lake with no stream coming in or out. Then you might be able to choose how to stop silt getting in, remove silt and spread it on your own land, provided that you looked after the welfare of any wildlife whilst doing so.

Water should flow onto, out of, or under your land in its natural quantity and quality. This means that water should not be taken out of a watercourse if it could lead to a lack of water for those who need it downstream. It also means that a person cannot carry out activities that could lead to pollution of the water and therefore reduce the natural water quality within a watercourse. If the silt is unnatural, then someone else might need to control it.

You may be able to reduce sedimentation on your land by altering flow patterns. You have the right to protect your property from flooding, and your land from erosion. However, you must get your plans agreed with the risk management authority before you start work.

You should keep the banks clear of anything that could cause an obstruction and increase flood risk, either on your land or downstream if it is washed away. You are responsible for maintaining the bed and banks of the watercourse and the trees and shrubs growing on the banks. You should also clear any litter and animal carcasses from the channel and banks, even if they did not come from your land. You may need your risk management authority's consent for these works, indeed, for any works close to a watercourse.

WHO CAN HELP?

Siltation affects all water bodies to a lesser or greater extent, so anyone with an interest in water is potentially affected. This has required us to focus our attention on those who can have the greatest impact.

Local water companies; will be impacted by siltation that can reduce the capacity of reservoirs and increase treatment costs for potable water. Therefore it is in the economic interest to help reduce siltation.

National environmental protection and regulation agencies (eg, Environment Agency); have a wide range of responsibilities that can be impacted by siltation, however the most significant is the impact on flooding where siltation can block watercourses and culverts.

Local authorities; have a responsibility for surface water flooding so are concerned about drains and local watercourses blocking with silt.

The Catchment Based Approach; (CaBA) is a community-led approach that engages people and groups from across society to help improve our water environments. CaBA Partnerships are now actively working in 100+ catchments across England and Wales. It is now recognised that stopping pollution (including soil run-off) at source is the best way to improve water quality. This requires the adoption of a catchment wide approach with all interested parties coming together to find mutually beneficial solutions. If your sailing club is affected by siltation why not influence the work of the Catchment Partnership?

Harbour Authorities; if you sail in the vicinity of an active port or harbour then they are likely to be undertaking some dredging to keep the navigational channels open.

HOW CAN WE REDUCE THE IMPACT ON OUR SAILING?

There are a number of techniques which can be used to reduce the impact that siltation and sedimentation has on recreational boating facilities.

If new facilities are being developed, particularly in an area where sedimentation is known to be an issue, consideration should be given to the best location and design of the proposals. Physical or mathematical modelling, alongside surveys, may be required in order to determine the best location and layout, however local knowledge and experience in sediment management can also be extremely valuable. Ensuring that infrastructure is placed in self-scouring areas can prevent significant maintenance costs in the long term. This could include techniques such as placing facilities in areas where there is naturally greater flow by considering bends or other topography (whilst ensuring that safety of navigation in maintained) or in areas where there is additional flow, such as where a tributary joins a channel.

Designs can also consider ensuring that moorings or pontoons for larger vessels are placed closer to self-scouring areas or structures can be put in place to channel natural flows through berthing areas. The internal design of a facility can also encourage water circulation to prevent sedimentation. Some marinas have proposed pumped artificial flows or other mechanical means to reduce the need for dredging, however these can be expensive to install and maintain. While it may be tempting to advocate barrages to maintain water depth above the level of silt, this should be approached with care as a barrage can slow flows and encourage more silt to accumulate above the structure, resulting in a further need to dredge. Similarly, if designing a sheltered, partially enclosed facility, consideration should be given to the location of the entrance to prevent sediment entering the area. Physical screens or bubble curtains can also be used to prevent silt entering an area.

Where a facility is sited behind lock gates, consideration should be given to the source of any sediment prior to designing the operation regime for the lock gates. Regular opening of lock gates can prevent build-up of sediment if the source is from upstream of the lock, as sediment will be flushed out downstream. However, if the source of sediment is from, for example, a tidal estuary outside of the lock gates, regular opening of the gates can allow more sediment to enter the basin and then settle out once the gates are closed.

Often, regular use of vessels within an area can prevent the settlement of silt within navigable channels and berths, however, siltation can be minimised by managing the source of the problem. Silt can build up as a result of run-off from land, surface water drains, or leaf litter entering the water. As previously discussed, working with local CaBA partnerships can be beneficial where sources of sediment are from the wider area (such as from agricultural activity upstream). Good tree management adjacent to enclosed waterbodies can reduce the amount of leaf litter accumulating on the bed of a waterbody, which would eventually break down into silt. Surface water entering waterbodies can be run through ‘silt traps’, where silt can be easily removed. Sediment traps can also be used in rivers to minimise the area required to be dredged by encouraging silt to ‘drop out’ in specific areas.

Surface water running into waterbodies can be routed into a specific area of water away from navigable areas where the dropout of silt is encouraged through planting with species such as the common reed. Planting up the margins of a waterbody where access by boats is not required can also prevent wind-blown leaf litter from entering the waterbody. Paved roads and parking areas can be a significant source of surface water run-off and sediment deposition, including areas for vehicles, boat trailers and boats. By placing areas away from the water’s edge, minimising the amount of impervious area, such as using gravel or permeable surfaces, or sloping surfaces away from the water’s edge with a planted buffer zone (ensuring that appropriate drainage is in place), there will be less runoff into the waterbody. Minimising run-off and pollution input into waterbodies

can also reduce the risk of contaminating sediment and subsequently affecting any future dredging costs.

HOW DO WE DREDGE?

How we dredge depends on the type, location and volume of material that needs to be removed or moved, and the contaminant content.

If the material is very soft and clean then a dispersive method can be used to move the sediment. Water injection, jetting or agitation is designed to put settled sediment back into suspension and be moved away by the water flow. If this is possible then there are considerations as to what flow (such as tidal direction) is most effective and where the material will then end up. This method is not very effective on coarse or cohesive sediments, however methods such as a plough which moves the sediment away from the area of concern.

If the material is coarser sands and gravels, or contaminated, then a removal method like a bucket or backhoe could be most appropriate. This reduces the contamination released into the water, for larger volumes a Trailer Suction Hopper Dredger could be used but mobilisation is often expensive. While the material may be clean enough to be disposed of to sea, or for beneficial reuse, if it is not needed or contaminated then the cost of disposal to a waste site can be high. In some situations, dredged material can be retained within the affected area by creating additional marginal habitat or berms. In some cases, the material can be placed on adjacent land.

Dredging and disposal requires permissions from different regulators depending on the nature and location of the activity. Seek advice early on in the process to understand what the costs, timings and other requirements of these regulators may be.

USEFUL DOCUMENTS

Good Practice Sediment Management – Environment Agency

http://evidence.environment-agency.gov.uk/FCERM/en/SC060065/MeasuresList/M1.aspx

Bypass Harbours at Littoral Transport Coasts

https://www.dhigroup.com/upload/publications/coastsea/Mangor-et-al%20PIANC_MMX.pdf

Estuary Edges design advice

http://www.ecrr.org/Portals/27/Publications/Estuary%20Edges%20-%20design%20advice.pdf