

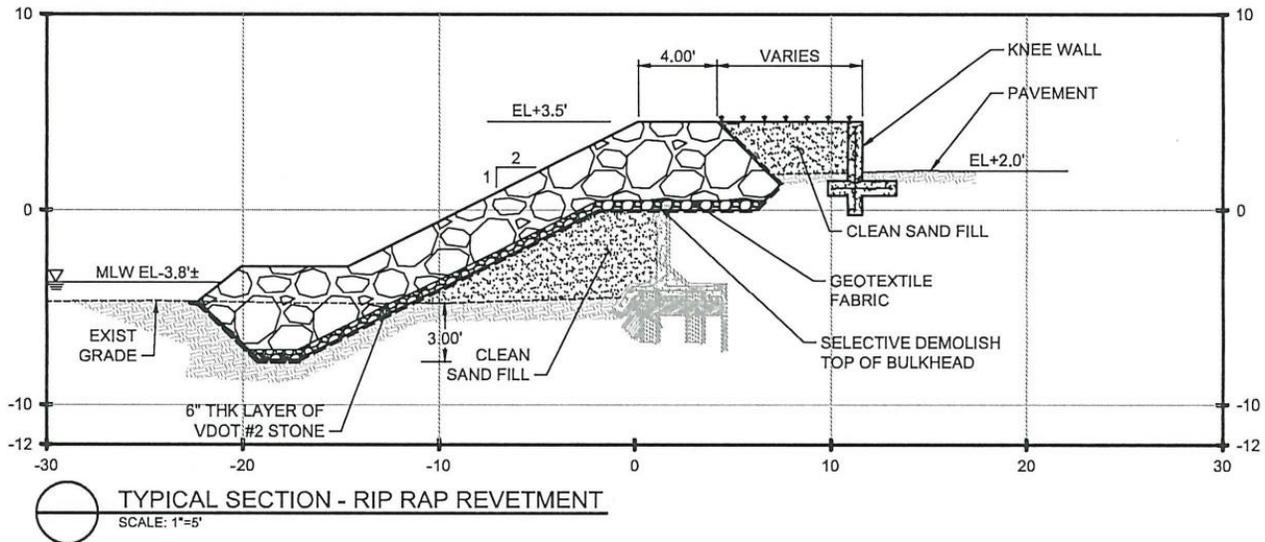
Surrey Crescent & Richmond Crescent
Current Bulkhead



Option #1

RIP RAP REVETMENT

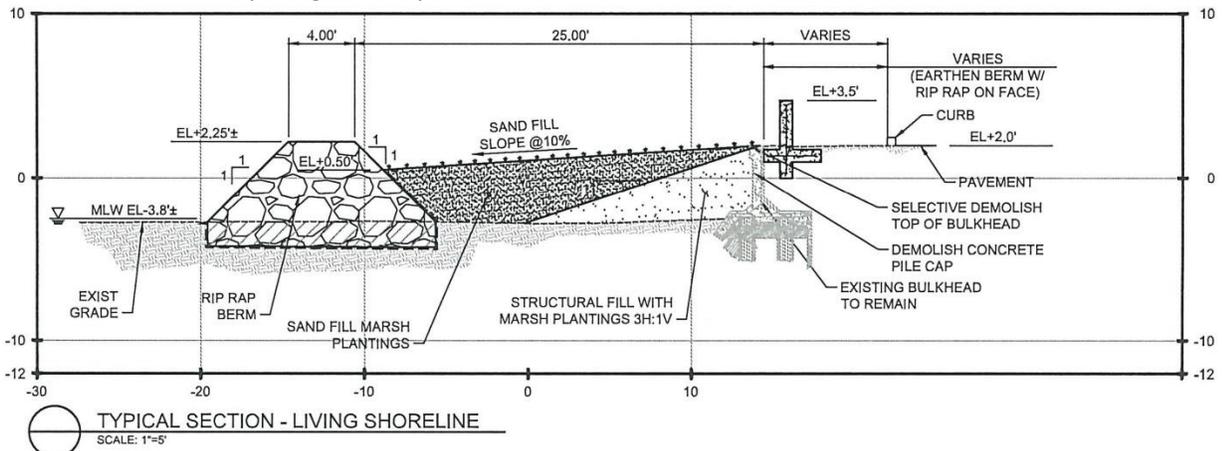
The existing bulkhead would be abandoned in-place and the shoreline would be reshaped to accept Rip Rap stone. The rip rap would resist wave action and dissipate the energies in its foundation. The rip rap revetment would be subject to some localized settlement but offers a low maintenance shoreline protection system. Water borne debris and litter can get caught up in the rip rap revetment, requiring periodic clean-up.



Option #2

LIVING SHORELINE

The existing bulkhead would be abandoned in-place. A rock sill would be installed approximately 25-feet off-shore. Coarse sand fill would be placed between the rock sill and the shoreline and planted with wetlands plants. The rock sill installation would allow the wetlands field to flood on the normal high tide. Settlement of the rock sill could take place requiring some repairs. Also, like the rip rap option, litter can collect requiring clean-ups from time to time.

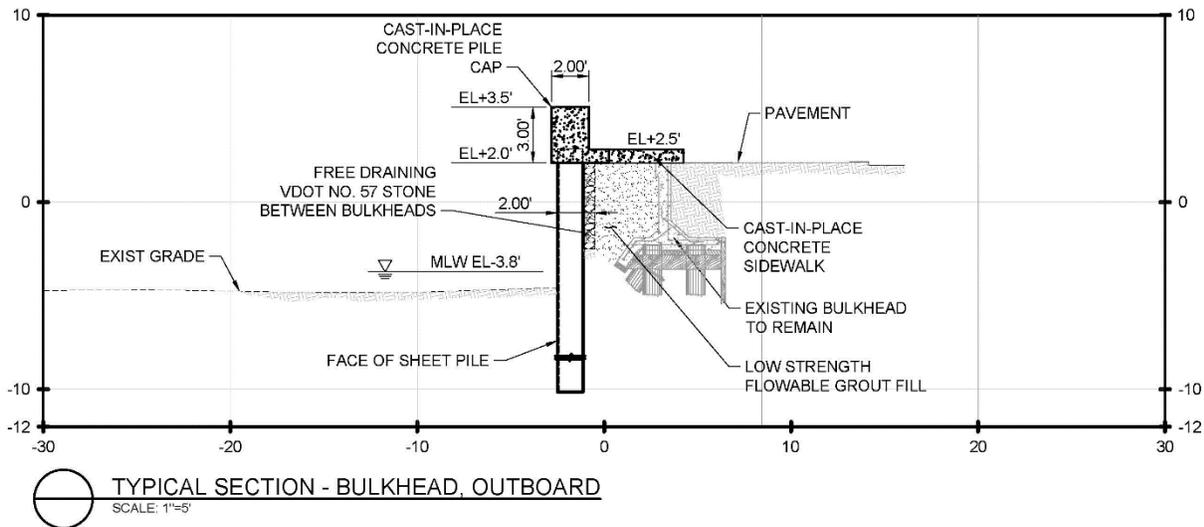


**The living shoreline option provides the city with some additional water quality credits to the City's Chesapeake Bay TMDL load reduction requirements.*

Option #3

BULKHEAD, OUTBOARD

The existing bulkhead would be replaced with a new steel sheet pile bulkhead with a concrete cap. The length of the sheet pile sections would be determined by a geotechnical engineer and extend above the existing bulkhead. To ensure constructability, the new sheet piles would be installed outboard of the existing bulkhead. The steel sheets are treated with a cold tar epoxy to resist corrosion and may include other corrosion inhibitors, such as impressed current or sacrificial anodes. Generally, a temporary steel frame is installed to ensure the alignment of the sheet pipe are straight, after sheets are driven in, the temporary frame is removed. The concrete cap is cast in-place after a section of the sheet piles are installed.



Permitting agencies have strongly preferred the living shorelines until very recently but are now likely to accept bulkhead replacement. The city will have to pay for mitigation of wetland vegetation which will be covered over at the top of the bulkhead, and if the installation is more than 2-feet from the existing bulkhead, the city would be obligated to mitigate the impacts to State bottom. The mitigation takes the form of payment into a State sponsored fund, which can be a very substantial amount.