Section 7. Conclusions and Recommendations

This ecological and public health assessment of the Grand Canal was based on sediment, water quality, and wetland/living resource analyses which was completed in 2016 for the Grand Canal and adjacent wetlands. These results were also compared to findings from data collected from the Grand Canal in 2004 to determine how conditions have changed over the past decade. It can be concluded that the canal system is severely impaired in terms of water quality, sediments, and habitat/living resources.

The Grand Canal has experienced impaired environmental quality due to pollution sources (such as septics and stormwater) which is exacerbated by canal geometry, inadequate stream flow and poor flushing. This is evidenced by the poor water quality observed within the canal system, particularly the low levels of dissolved oxygen, high levels of bacterial contaminants (coliforms), and high nutrient enrichment. Water quality in the canal has been significantly impacted by nutrient enrichment which can adversely affect marine productivity, and dissolved oxygen readings were often found below levels necessary for healthy aquatic life. These impairments in water quality have been documented for over a decade in the Grand Canal as evidenced in the 2005 report on the Grand Canal. Although the 2005 report concluded that water quality in the Grand Canal was impaired, generally conditions have been observed to have worsened over the past decade. In addition to poor water quality, sediments sampled from multiple locations throughout the Grand Canal were found to be acutely and chronically toxic to aquatic life. Therefore, these toxic sediments are impairing the ecological quality of the Grand Canal.

Bathymetric surveys of the Grand Canal indicated reduced channel depths throughout the canal system, which may impact tidal flow and also impede navigation. Observations documented during the current Grand Canal study by environmental field personnel also indicted an abundance of debris within the canal.

The marshes in the Grand Canal study area are all considered to be severely-stressed, particularly when compared to large salt marsh complexes in less disturbed landscape settings. Each assessed marsh in the Grand Canal Pickman-Remmer system is surrounded by intensive development which has reduced protective buffers, halted the ability of the marsh to shift landward with increasing sea levels, and has subjected the marshes to inputs of contaminants, sediments, freshwater, yard waste and other debris. All marshes are artificially ditched, two of the three marshes (northwest and east) have significant restrictions in tidal flow from the Grand Canal (which itself is somewhat restricted), and all are experiencing some shoreline erosion from wave action. In addition, the invasive common reed occurs throughout all marsh complexes and is dominant in two of the three systems (east and northwest). Furthermore, significant loss of wetlands in the Grand Canal study area has been observed over time.

With regards to public health, the results from the bacterial indicator testing indicated that bacterial contamination is a significant issue throughout the Grand Canal, as elevated coliform levels were frequently observed. Surface waters in the Grand Canal are unlikely to be safe for primary contact recreation. Additionally, the quality of the fish inhabiting the Grand Canal may be compromised (e.g., for purposes of human consumption) by the microbiological contamination.

IMM in conjunction with berm removal or alteration is proposed as an approach which will alleviate the numerous ecological and public health impairments in the Grand Canal. IMM will facilitate fish access, increase tidal flow and reduce stagnant waters in wetlands, both of which may reduce mosquito breeding near the Grand Canal. Increased tidal flow may also help to reduce the retention time of bacteria and nutrients within the canal, resulting in lower observed coliform and nutrient levels, as well as improve impaired water quality parameters, such as DO. IMM can also serve to improve the health of the wetlands near the Grand Canal by: reducing common reed populations; increasing native vegetation; increasing vegetative diversity; and improving wildlife maneuverability throughout marshes adjacent to the Grand Canal. Lastly, limited dredging of the Grand Canal can increase canal navigability by deepening channels and removing debris, but dredging will not ultimately increase tidal flow or address sources of contamination to the canal system.

A summary of the study conclusions and recommendations for follow-up actions are presented below:

- Bacteria levels in canal water are elevated, and discharges from on-site sanitary systems appear to be major contributors. Improvements and upgrade of on-site sanitary systems would decrease discharge of bacteria and nutrients to surface waters and assist in long term water quality improvement. Further investigation beyond the scope of this study would be required to determine the level of contribution from the on-site sanitary systems.
- Dredging and deepening of inner portions of the canal, without widening or deepening of its connections to the Connetquot River or adjacent wetlands, will not improve flushing rates for the canal. However, due to the commercial and residential development at the mouths of the canal, widening these areas is not a feasible option. In fact, deepening of the canal without increasing water flow could result in greater volumes of stagnant water in the canal. The exception would be dredging the shoals located in the southern portion of the canal, which could provide slight increase in tidal exchange by slightly reducing partial barriers to water exchange between the canal and Connetquot River. Improvements would be minimal and short-lived as sediments re-accumulate.
- Dredging would result in the removal of contaminated sediments; however, the removal would not result in improved long-term conditions unless the sources of contamination are controlled (e.g., sanitary waste, stormwater, etc.). There are multiple anthropogenic sources of contamination associated with existing land uses that will continue to affect the canal unless long-term abatement measures are taken.
- Erosion of the banks, especially along the man-made berm, is continuing along with shoreline failure from deteriorated bulkheads. Increased sedimentation will result in the filling in of the canal if dredging were to be performed. These sources of sediments will continue, and dredging could actually accelerate sedimentation by causing increased instability of the canal bottom and banks. Sediment control measures, including shoreline stabilization, are needed to prevent further sedimentation of the canal.

- The public health and environmental risk assessments performed for surface water and sediments did not indicate a level of risk higher than would be expected in a water body subject to anthropogenic inputs in a semi-developed area. In other words, the risks from contamination are not higher than usual for similar developed areas in the region.
- The wetlands adjacent to the canal along the south side are experiencing continued serious erosion from inadequate tidal exchange, reduced salinity, and the spread of invasive species. Although the wetland still provides a valuable habitat for water fowl, fish and other wildlife, the quality of the wetland will continue to degrade unless remedial measures are taken.
- Long-term health and viability of the wetlands can be improved by implementing marsh management which significantly increases tidal exchange into and out of the wetlands. Integrated Marsh Management (IMM) would have multiple benefits of improving the quality of the wetland, improving water quality conditions in the canal, decreasing the potential for mosquito larvae production and need for mosquito control measures, and providing improved coastal resiliency and buffering during coastal storms and long-term sea level rise. Tidal exchange into the wetlands could be increased by removing significant portions or all of the man-made berms presently separating the wetlands from the canal.
- Significantly improving tidal exchange for the wetland would provide improved flushing of the canal by providing additional volumes of water within the tidal range which would be subject to tidal action on a daily basis. Removing the berm would allow greater volumes of water to enter and exit the canal with each tidal cycle, although the narrow south opening of the canal with the Connetquot River will limit the full extent of tidal exchange which can be achieved.
- IMM improvements including berm alterations for the adjacent wetlands would provide long-term water quality and habitat improvements to the canal and associated wetlands. IMM measures should include creation of additional channels and areas of open water, removal of invasive species, and grading modifications to provide improved water flow.
- Although not found to be the primary effect on bacterial levels in the canal, direct stormwater discharges contribute to the input of nutrients and other containments. Actions to eliminate direct discharges and provide increased treatment of stormwater runoff,

through application of bio-swales, constructed wetlands, and similar technologies, will contribute to long-term water quality improvements.

- The investigation indicated that significant portions of the canal have debris including tree debris, limbs and cuttings. This debris, especially within the portion of the water column in the tidal range, can restrict water flow and accelerate the sedimentation and accumulation of additional debris. Action to remove the limbs, cuttings and similar debris would improve water flow, reduce accumulation of additional debris, and have short-term benefits to water quality.
- Even if dredging was determined to be a beneficial action, standard Suffolk County protocol and procedures relating to set backs from shorelines and bulkheads and maximum allowed side slopes of dredge areas could not be followed in many areas of the canal because the canal is very narrow and it banks contain bulkheads on private property. Granting of legal releases, hold-harmless agreements and similar legal protection to the County by home owners may protect the County from liability relating to damaged or undermined bulkheads, but would not prevent the physical erosion of the shoreline and accelerated release of sediment to the channel that would occur from shoreline failures relating to bulkhead failures.
- It should be noted that the New York Rising Oakdale / West Sayville Report (March 2014) identified an improvement project that would improve tidal exchange to the Pickman-Remmer Wetland by installing seven 24-inch pipes through the berm and other improvements. Benefits would include improved tidal flow into the wetlands and greater capacity of the wetland to absorb storm surge and stormwater runoff. The findings of the present investigation concur with this finding, except that considerations should be given to providing even greater channels for tidal exchange by removal of the berm or portions of the berm.