

EXECUTIVE SUMMARY

Hydrodynamic Model Study Results, Craney Island Eastward Expansion

1. The CIEE Hydrodynamic Model Study was conducted in three phases: 1) model calibration and verification for the Elizabeth River, 2) model testing of four Craney Island expansion options using *single variable runs* (using a single variable, tidal range, for model input), 3) model testing of two expansion options using *historical runs* (using multiple variables in real time for model input). The expansion option designs were evaluated for both global and local hydrodynamic change through simulation comparisons with the Base Case condition.
2. Global evaluation was conducted for Hampton Roads and the Elizabeth River by enumerating percentages of total area associated with class intervals of change in a particular property such as RMS difference in water surface elevation. Other properties evaluated by area percentile analysis included current magnitude, surface and bottom salinity, and bottom sedimentation potential.
3. Local evaluation was conducted in specific areas containing features considered important to estuarine circulation (e.g., tidal fronts, eddies, tidal prism and non-tidal flux in tributaries) and in areas of change pinpointed by global analysis.
4. Of the four expansion designs tested in the single variable runs, global analysis revealed that northward expansion (Option 6) and northeast expansion (Option 9) produced noticeably greater percentile changes in water surface elevation, current magnitude, salinity, and bottom sedimentation potential. Westward expansion (Option 5) produced a lesser degree of change. Eastward expansion (Option 7) produced only minor changes in the immediate vicinity of Craney Island.
5. Strong westerly surface and bottom currents were indicated in the berthing channel on the north side of Option 6 and are believed responsible for a significant increase in bottom salinity noted west of Craney Island and extending to the Nansemond River entrance.
6. Local analysis revealed no appreciable change in flushing ability in either the Elizabeth River basin or the Lafayette River for any of the options tested. Option 6, however, produced noticeable changes in simulated residual currents within the Elizabeth River and in areas between Newport News Point and Craney Island

Global Change – 95th Percentile (5% of area contains change greater than value listed)				
Single Variable – 50’ Channel Cases				
Change in:	Case 2 East 50’ channel	Case 4 West 50’ channel	Case 6 North 50’ channel	Case 8 North/East 50’ channel
Surface Elevation	0.14 cm	0.34 cm	1.00 cm	1.04 cm
Surface Current	2.4 cm/s	5.3 cm/s	12.3 cm/s	11.7 cm/s
Bottom Current	1.6 cm/s	3.3 cm/s	7.8 cm/s	6.6 cm/s
Surface Salinity	0.00 ppt	0.12 ppt	0.71 ppt	0.23 ppt
Bottom Salinity	0.00 ppt	0.35 ppt	1.00 ppt	0.23 ppt
Sedimentation Potential	0.08 %	2.8 %	8.9 %	6.3 %
Single Variable – 55’ Channel Cases				
Change in:	Case 3 East 55’ channel	Case 5 West 55’ channel	Case 7 North 55’ channel	Case 9 North/East 55’ channel
Surface Elevation	0.22 cm	0.42 cm	1.05 cm	1.11 cm
Surface Current	2.6 cm/s	5.5 cm/s	12.5 cm/s	11.8 cm/s
Bottom Current	1.7 cm/s	3.5 cm/s	8.0 cm/s	6.6 cm/s
Surface Salinity	0.03 ppt	0.10 ppt	0.74 ppt	0.23 ppt
Bottom Salinity	0.04 ppt	0.31 ppt	1.07 ppt	0.21 ppt
Sedimentation Potential	0.80 %	3.7 %	10.1 %	6.8 %

Global Change – 95th Percentile (5% of area contains change greater than value listed)				
Historical – High Discharge Event				
Change in:	Case 2 East	Case 3 East	Case 10 East/West	Case 11 East/West

Historical – Low Discharge Event				
Change in:	Case 2 East 50' channel	Case 3 East 55' channel	Case 10 East/West 50' channel	Case11 East/West 55' channel
Surface Elevation	0.14 cm	0.21 cm	0.33 cm	0.40 cm
Surface Current	2.7 cm/s	2.8 cm/s	4.3 cm/s	4.3 cm/s
Bottom Current	1.9 cm/s	1.9 cm/s	2.9 cm/s	2.8 cm/s
Surface Salinity	0.00 ppt	0.00 ppt	0.04 ppt	0.01 ppt
Bottom Salinity	0.01 ppt	0.04 ppt	0.09 ppt	0.08 ppt
Sedimentation Potential	0.9 %	1.2 %	2.8 %	3.0 %
Historical – High Wind Event				
Change in:	Case 2 East 50' channel	Case 3 East 55' channel	Case 10 East/West 50' channel	Case11 East/West 55' channel
Surface Elevation	0.21 cm	0.25 cm	0.46 cm	0.57 cm
Surface Current	2.2 cm/s	2.5 cm/sec	5.0 cm/s	5.0 cm/s
Bottom Current	1.5 cm/s	2.4 cm/s	3.0 cm/s	3.1 cm/s
Surface Salinity	0.00 ppt	0.00 ppt	0.00 ppt	0.01 ppt
Bottom Salinity	0.00 ppt	0.08 ppt	0.02 ppt	0.08 ppt
Sedimentation Potential	0.8 %	0.9 %	1.7 %	1.9 %