

A Statement of Developing a Water Quality Model in the Lower James

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The degree to which a development project in tidal waters will impact water quality can be evaluated by considering two factors:

1. The increase in nutrient or toxics-loadings in the water column generated by the project. If pollutant loads will increase as a result of the project, there is a potential for degradation of local conditions. The degree of degradation will be dependent on existing conditions and the relative change in loads caused by the project.
2. The alteration of circulation patterns caused by the project. In general, if the project design will result in locally increased retention times or increased water column stratification, the potential for degraded water quality conditions exists. Again, the degree of hydrodynamic change will influence the potential for degradation.

In the case of the proposed expansions of Craney Island, there are three areas of potential concern for water quality impacts: (1) the Elizabeth River, (2) Hampton Roads, and (3) the nearshore area west of Craney Island.

The loads of nutrients and/or other pollutants introduced to surface waters as a consequence of Craney Island expansion(s) will be dependent on the location and design of the surface runoff control structures built into the Island. It may be possible to estimate potential loads by monitoring existing outfalls, assuming future fill material will be similar in composition to current fill. Evaluating the significance of these loads will require information on location of new discharges.

The hydrodynamic modeling done to date for this project is least detailed in the area to the west of Craney Island where grid resolution is comparatively coarse and only approximately represents the shape of the designed expansion boundary. This means that assessment of potential water quality impacts based on changes in circulation would lack precision in this area. For the other areas, the existing modeling does not suggest an increase in residence time or an increase in stratification adjacent to the Island under any of the potential project designs.

Modeling water quality in the nearfield tidal waters surrounding Craney Island is a non-trivial task. While the technology for development of an adequate simulation model is available, time and effort is needed to implement it. Calibration and verification of the

model require significant field and analytical effort. Calibration is the initial process of utilizing field data to obtain adequate model-prototype agreement by adjusting model parameters. Verification is the follow-up process of verifying the agreement through comparison of model predictions with independent data sets. For water quality modeling, this requires knowledge of boundary conditions in the estuary as well as identification of all existing and proposed loads from the surrounding land mass. Only when this has been accomplished can simulation of proposed changes commence.

Modeling of water quality conditions attendant various designs for the expansion of Craney Island will require:

1. Implementation of a near-field hydrodynamic model, capable of conforming the grid to the designed shape of the expansion, along the west portion of the Island
2. Identification of the location and character of new loads associated with various design options;
3. Development, calibration and verification of the water quality simulation model;
4. Application of the model and analysis of model output for identified design alternatives.