



South Bethany Canals Flushing Study

Proposed Tidal Pump System Residence Time Analysis

Mike Fichera

ENTRIX, Inc.

New Castle, DE

Venkat Kolluru

J.E.Edinger Associates/ERM

Wayne, PA



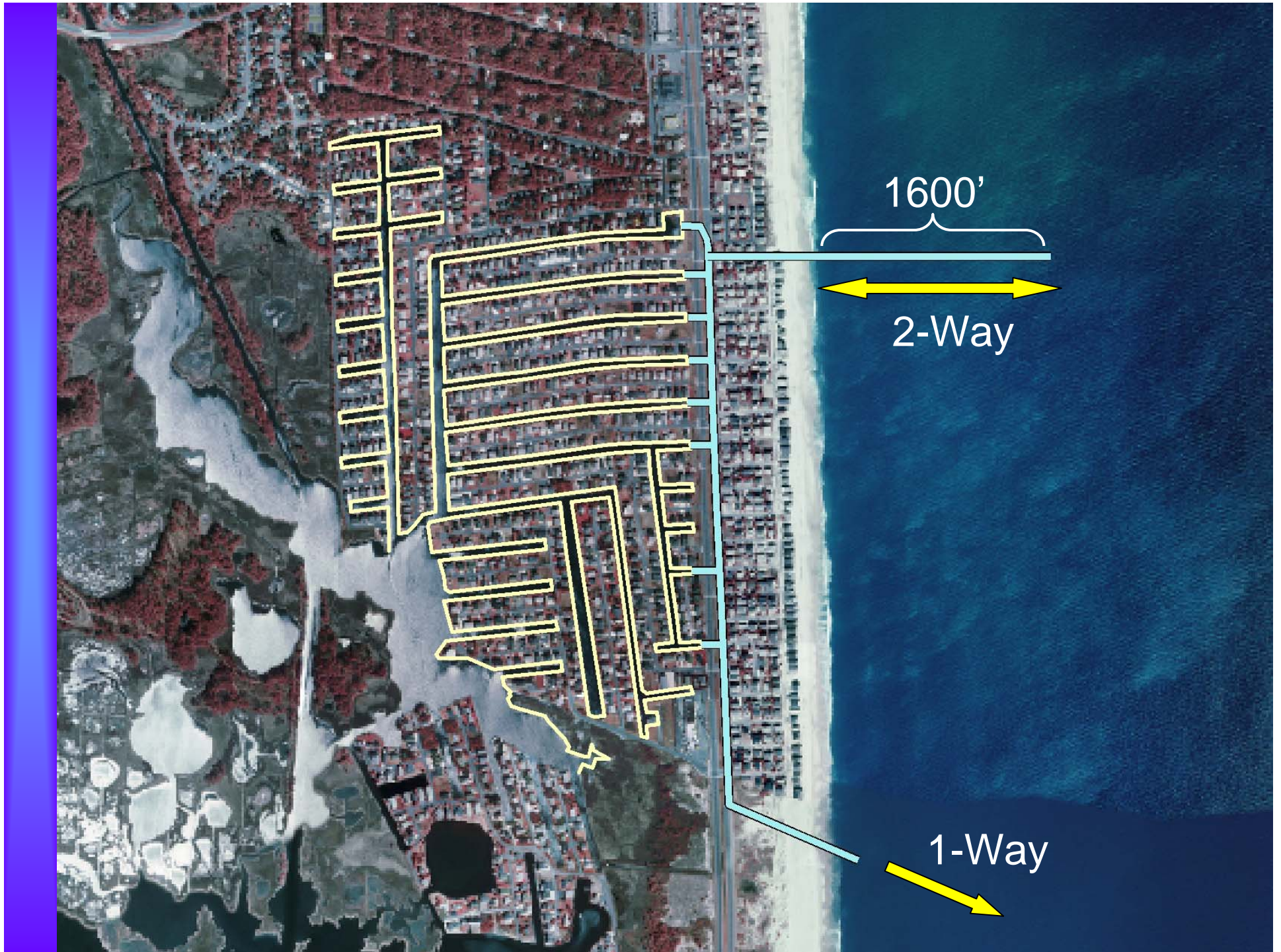
Background

- South Bethany Canals: poor water quality
 - low DO
 - high nutrients
 - high bacteria
 - high algae
 - poor species diversity
 - odors
- Root cause: poor circulation

Proposed solution

- Hughes Pipe Network
 - Direct connection to the Atlantic Ocean
 - Run under Route 1
 - Tidally driven by elevation differential
 - While ocean ebbs, canals flood, etc.





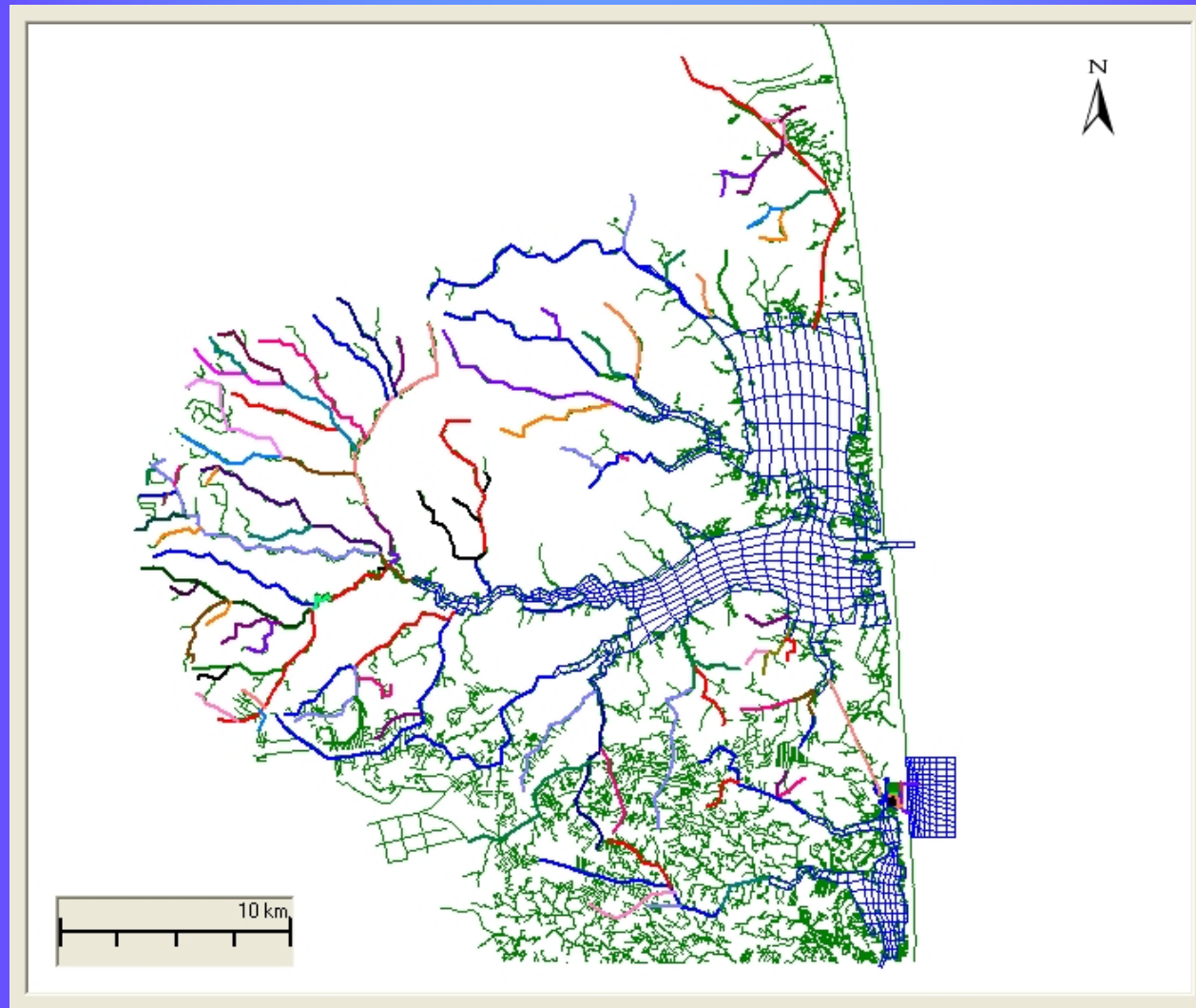
Project Goal

- Examine the effectiveness of Hughes Tidal Pump system in flushing the South Bethany Canals with ocean water
 - create a simulation to confirm the functionality of the system
 - simulate a dye study within the canals.
 - effectiveness measured in terms of the changes in the residence time

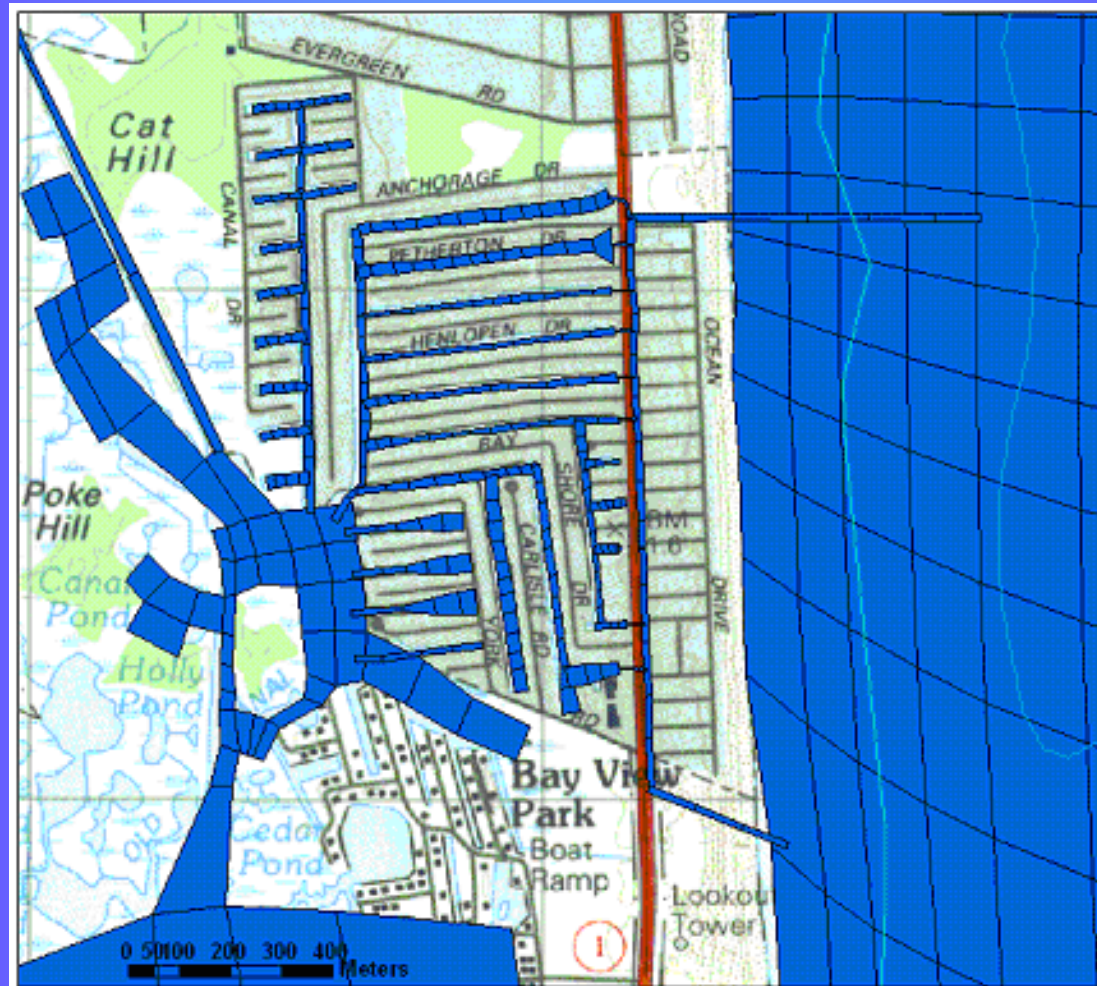
Modeling

- Used GEMSS Model
 - 3D, hydrodynamic / water quality modeling system with GIS
- Previously used for
 - the Inland Bays Flushing Study
 - Inland Bays TMDL Analysis
- Used existing data from Year 2000
- 2 model runs
 - residence time with / without tidal pump

GEMSS-Inland Bays modeling grids with South Bethany/Atlantic Ocean expansion



Modeling grids for the South Bethany canals and pipe network



Hydrodynamic Model Output Velocity Vectors

Hours in the day



Date



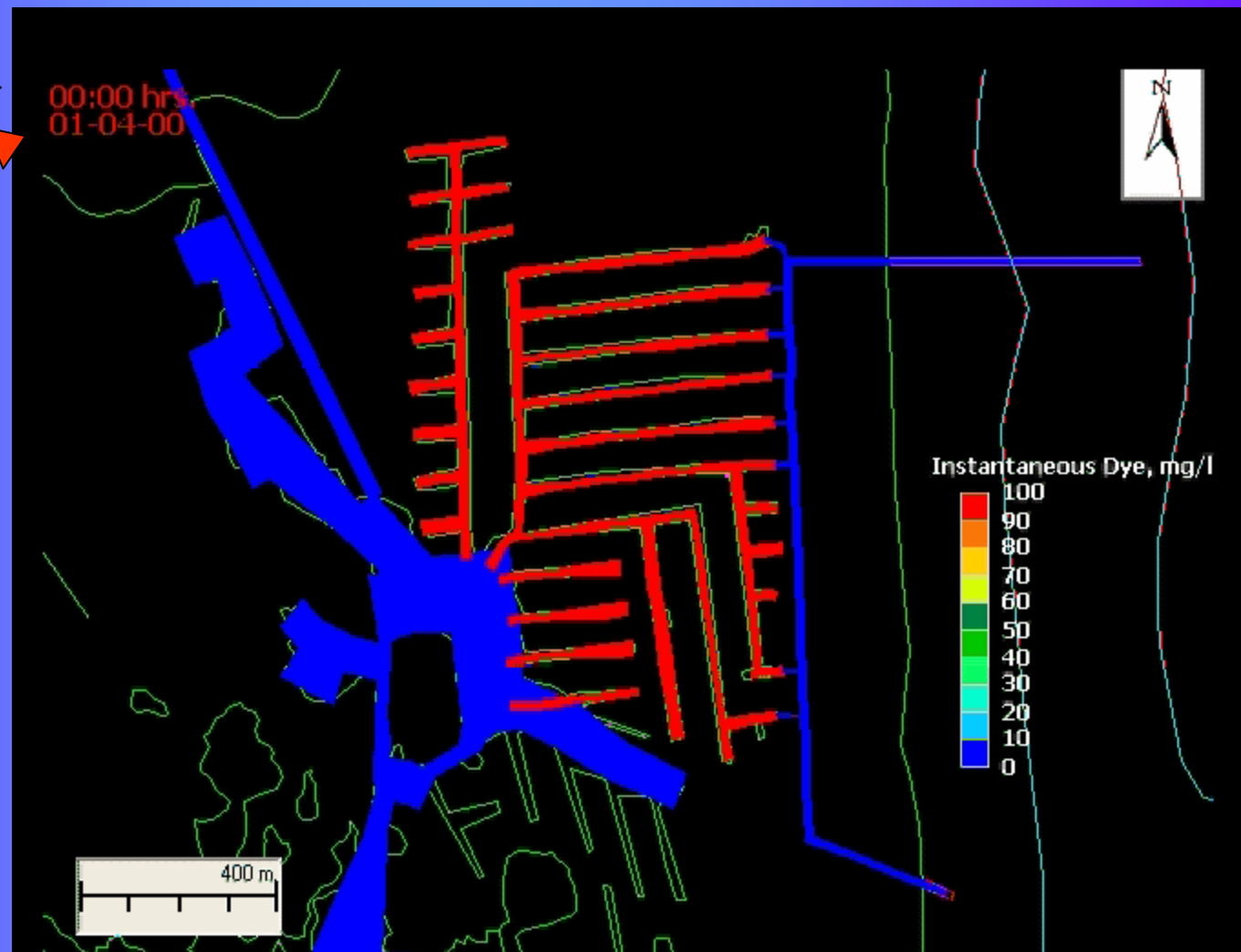
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Dye concentrations at initial conditions (start of dye dump)

Hours since
start of dye dump

Date of model
snapshot

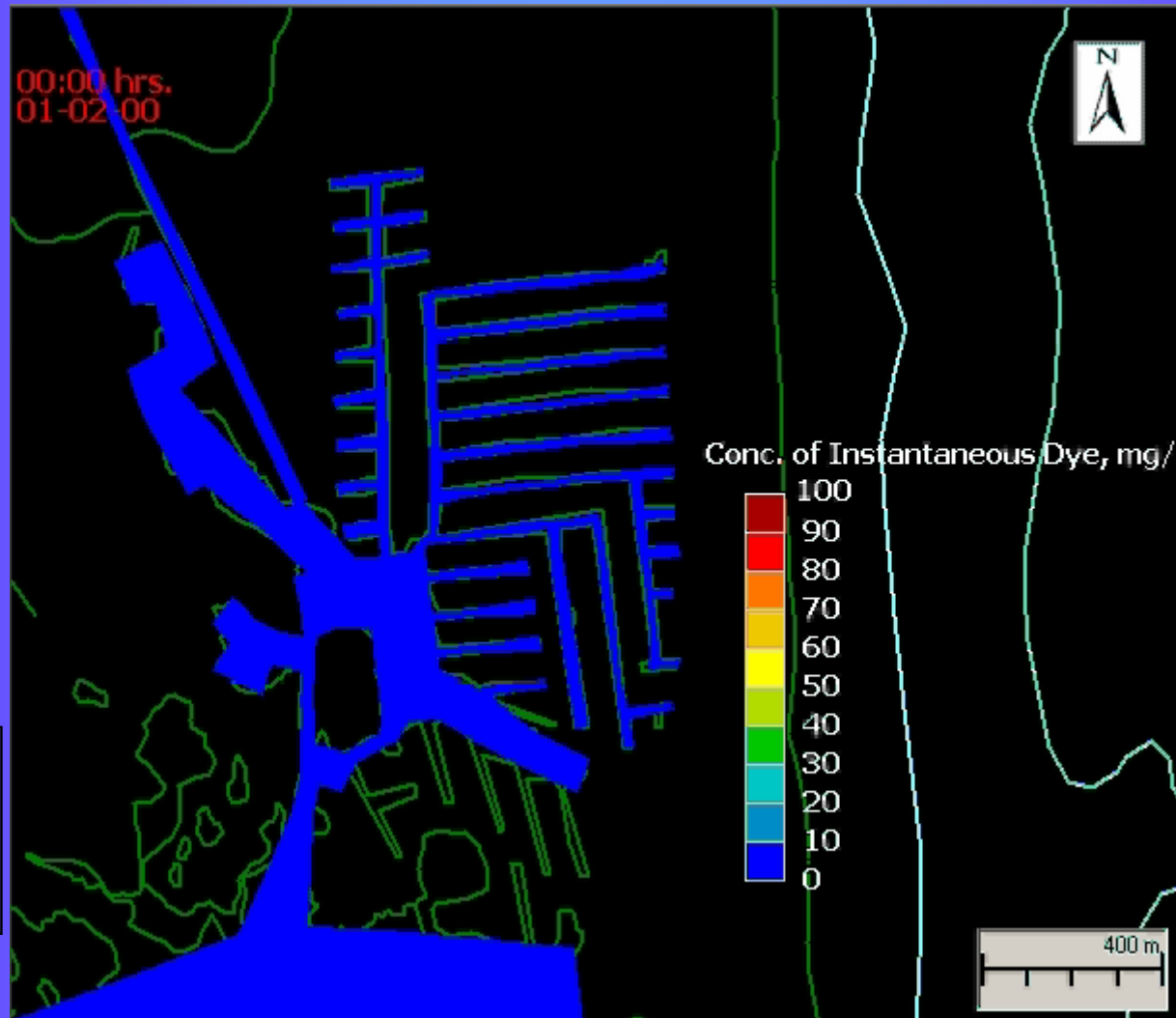


Instantaneous Dye Dump Current Conditions

Jan 2, 2000
to
Apr 30, 2000

Dye concentration
starts at 100 mg/L
on Jan 1, 2000
within the canals

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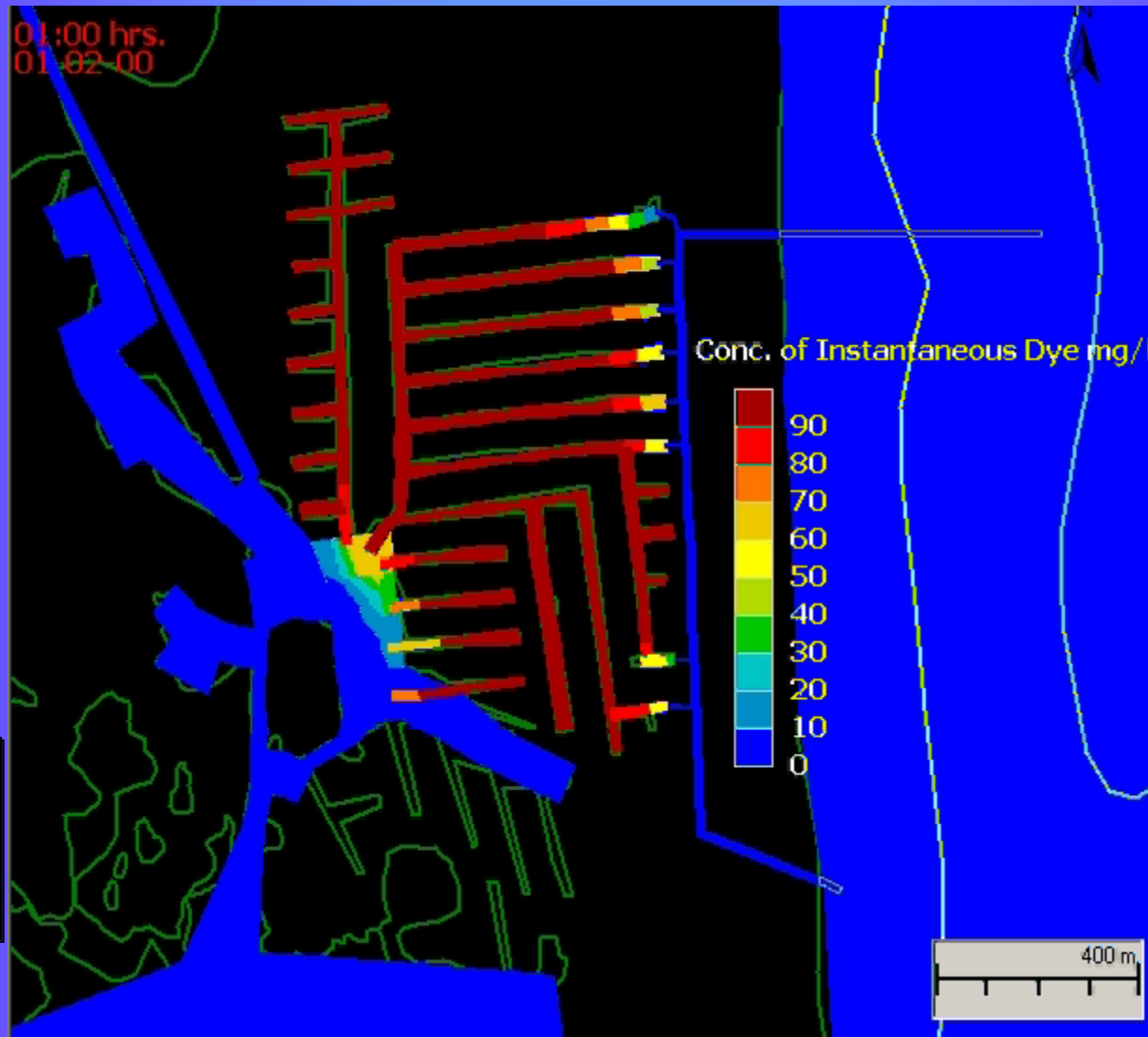


Instantaneous Dye Dump Tidal Pump Conditions

Jan 2, 2000
to
Jan 31, 2000

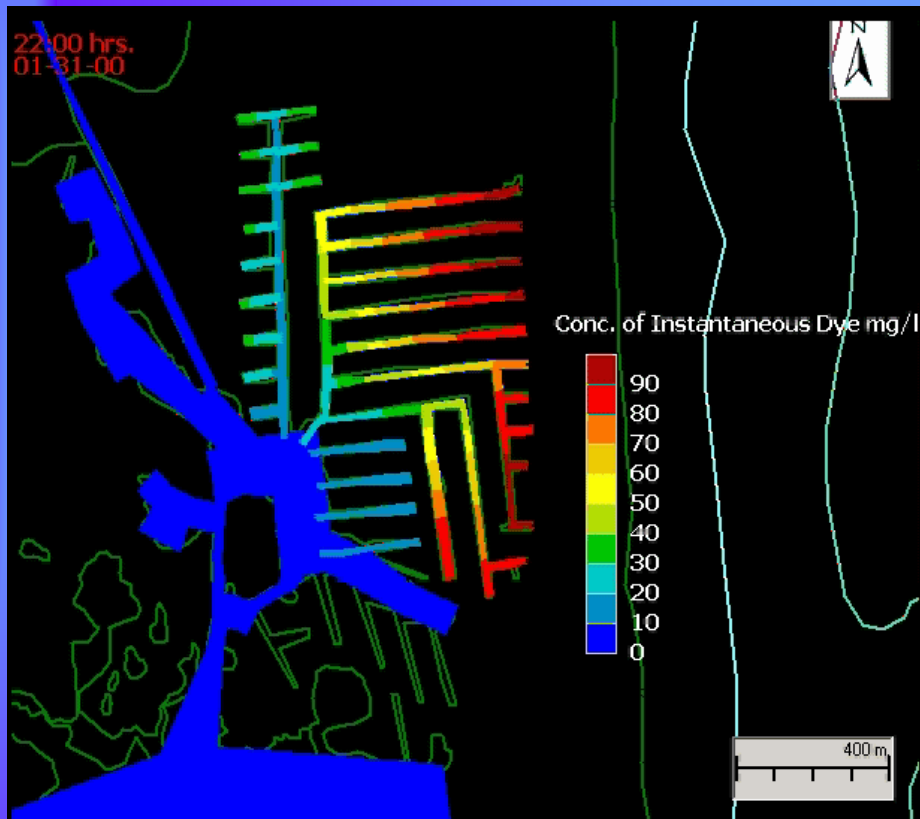
Dye concentration
starts at 100 mg/L
on Jan 1, 2000
within the canals

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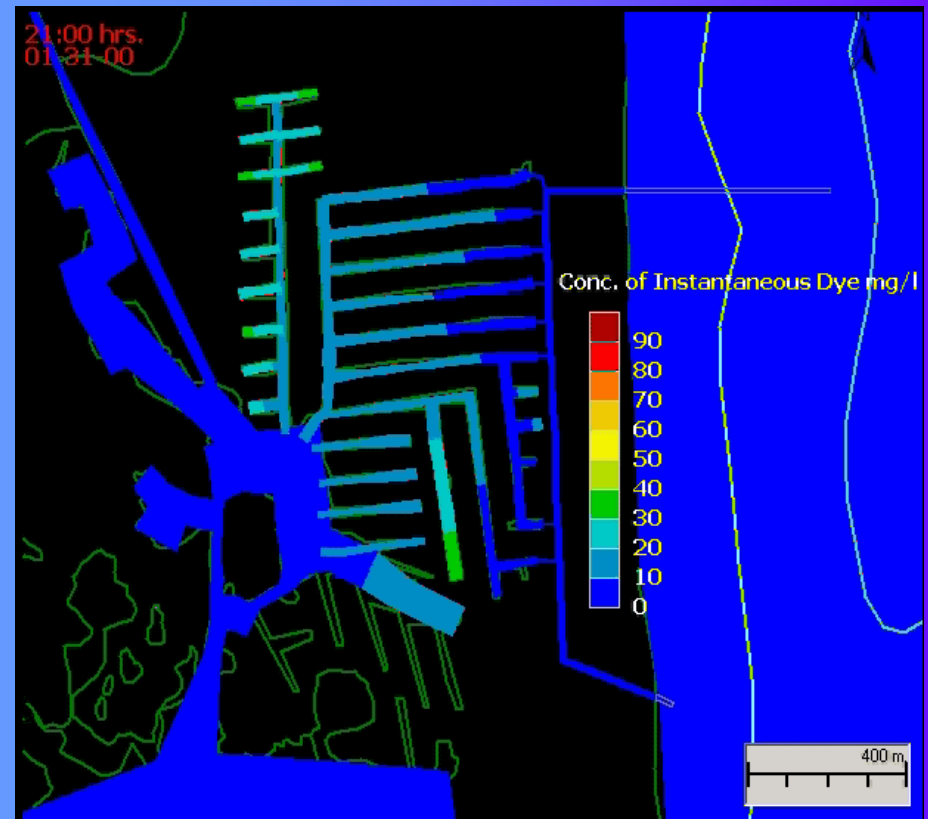


Dye concentrations after 1 month from release

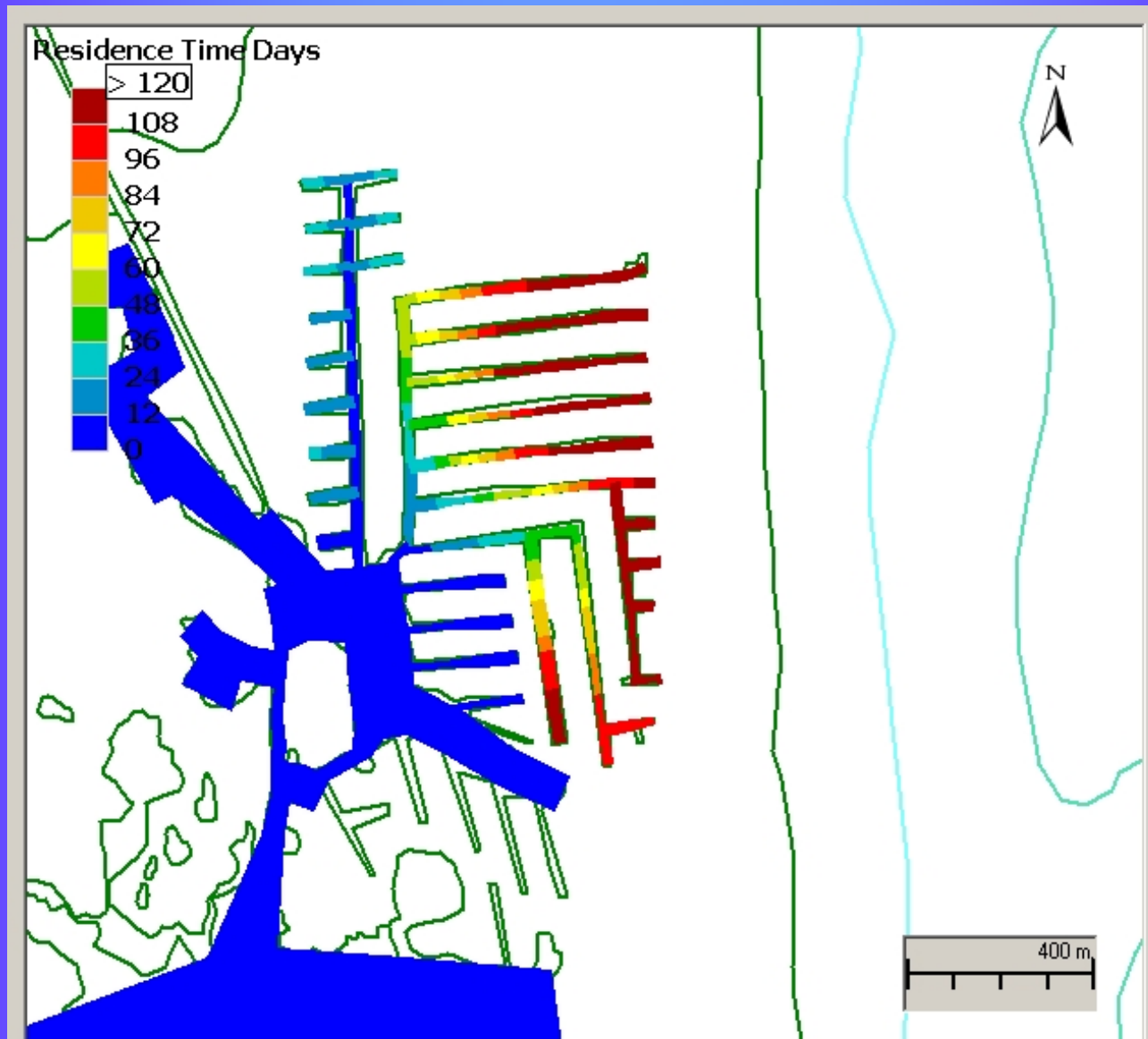
Current Conditions



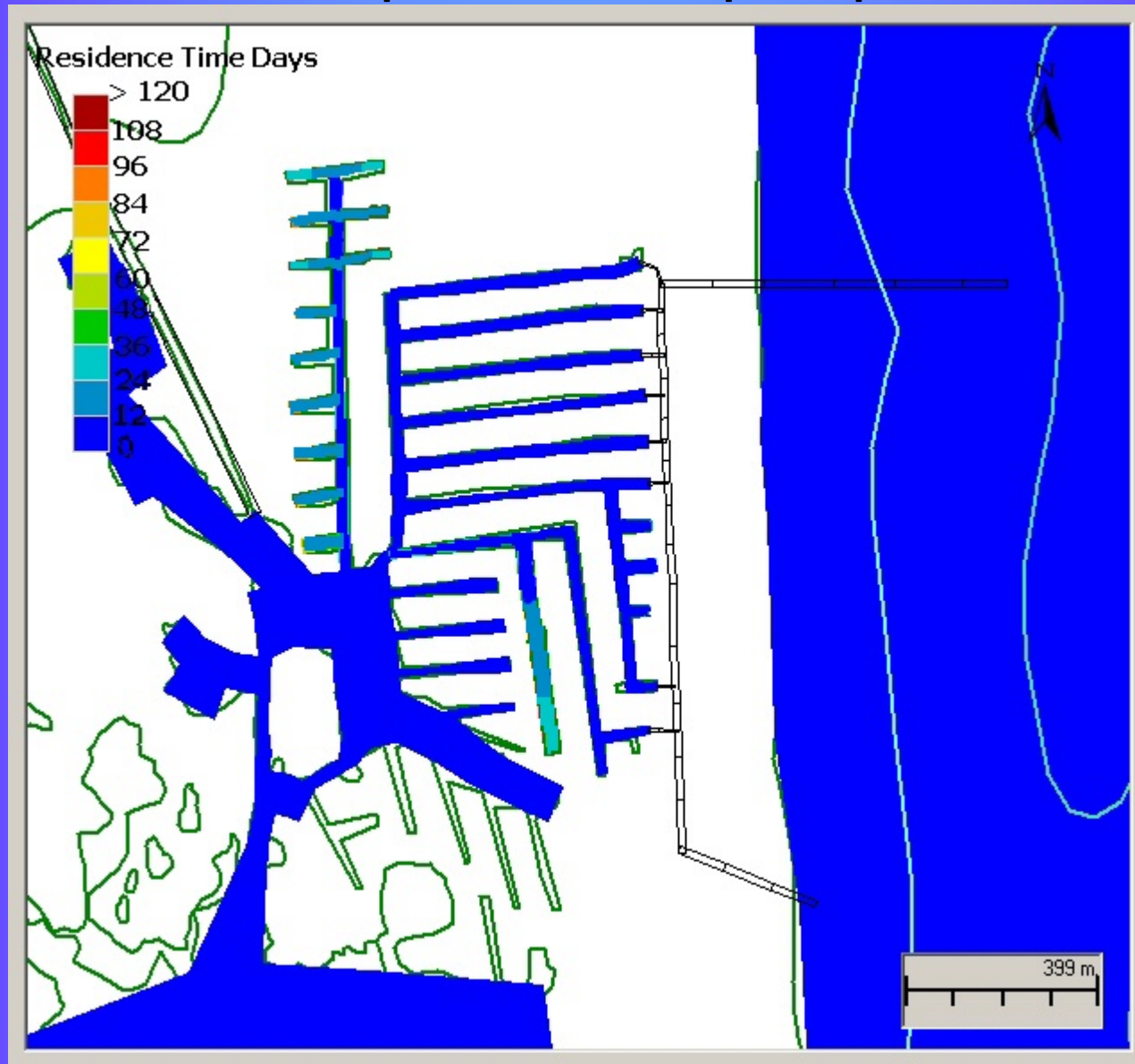
Proposed Tidal Pump



Residence times in the South Bethany canals Current Conditions

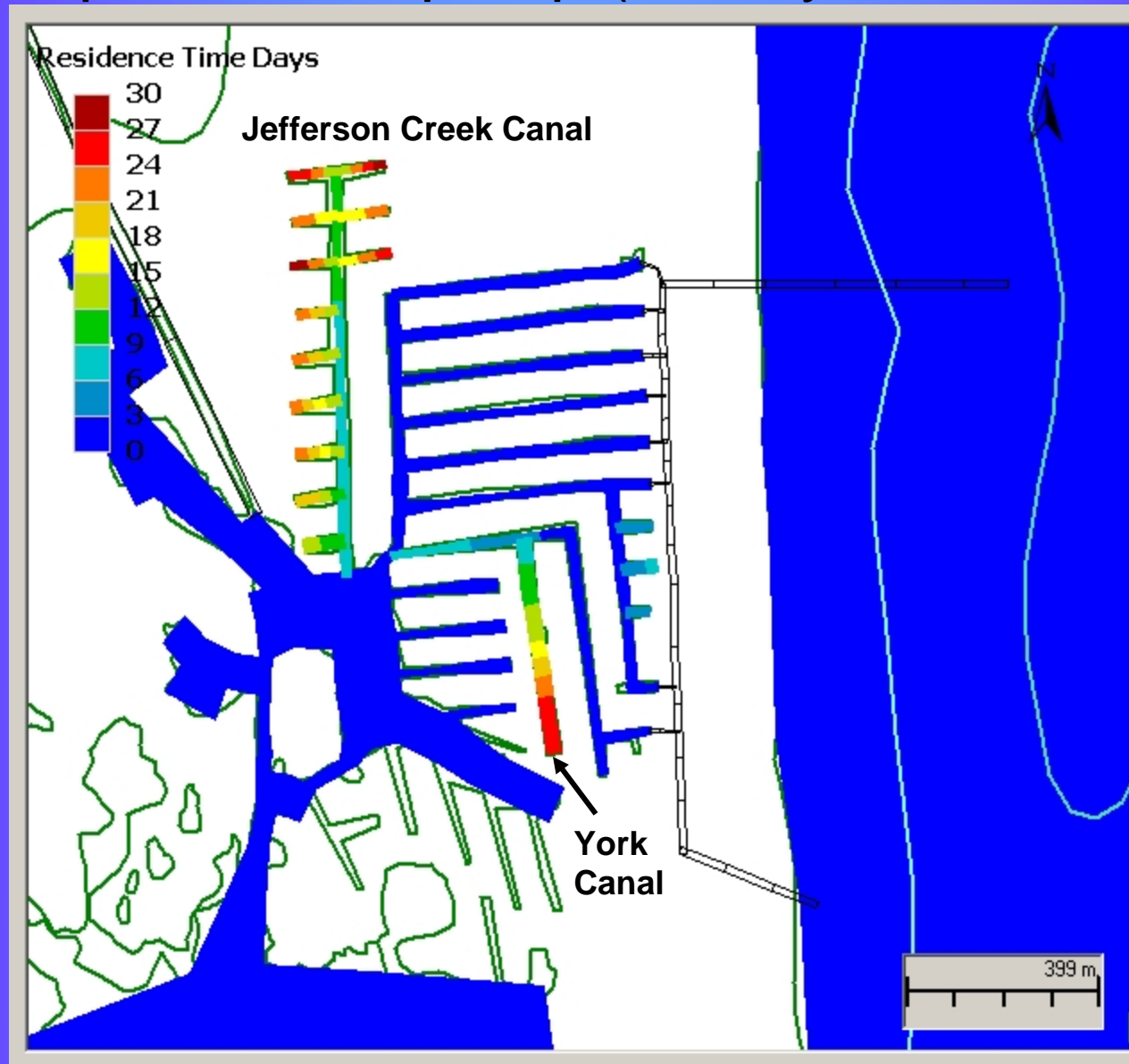


Residence times in the South Bethany canals Proposed tidal pump



Residence times in the South Bethany canals

Proposed tidal pump (30-day color scale)



Conclusions

- The proposed Hughes Tidal Pump system can be an effective method to exchange the waters within the South Bethany Canals
- Increase quantity of flow - expect improved quality of water
- Additional pipes may be needed
- Increased exchange will have some effect in Little Assawoman's residence time